RWE Renewables UK Dogger Bank South (West) Limited

RWE Renewables UK Dogger Bank South (East) Limited

Dogger Bank South Offshore Wind Farms

Preliminary Environmental Information Report

Chapter 17 – Offshore Archaeology and Cultural Heritage

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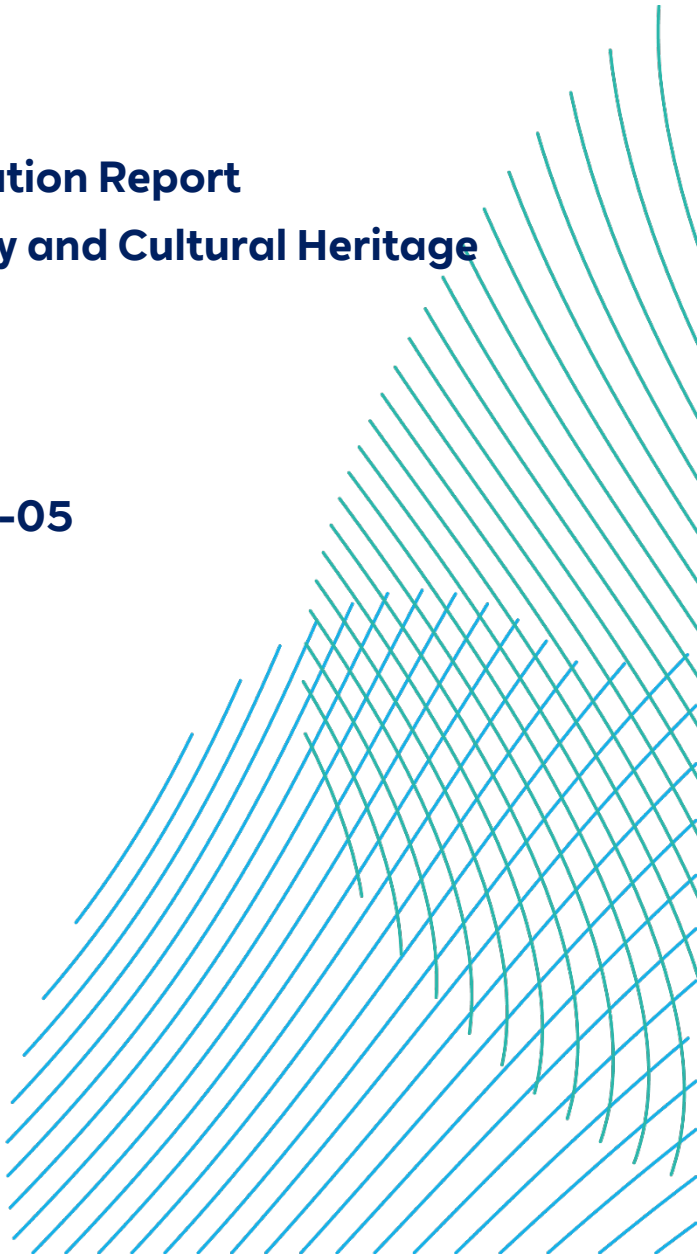

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Glossary

Term	Definition
Accommodation Platform	An offshore platform (situated within either the DBS East or DBS West array area) that will provide accommodation and mess facilities for staff when carrying out maintenance activities for the Projects.
Array Areas	The DBS East and DBS West offshore array areas, where the wind turbines and array cables will be located. The "array areas" do not include the offshore export cable corridor.
Array Cables	The cables which link the wind turbines to the offshore substation/converter platform(s).
Aviation Archaeology	The remains of crashed aircraft and archaeological material associated with historic aviation activities.
Dogger Bank South (DBS) Offshore Wind Farms	The collective name for the two Projects, DBS East and DBS West.
Electrical Switching Platform (ESP)	The electrical switching platform (if required) will provide a link to a co-ordinated east coast transmission system which is planned to run from Scotland to England, as per National Grid ESO's Holistic Design Network. This platform may be located either within one of the array areas (alongside a converter station) or mid-way along the export cable corridor (likely next to the Reactive Compensation Platform if required).
Geoarchaeology	The application of earth science principles and techniques to the understanding of the archaeological record. Includes the study of soils and sediments and of natural physical processes that affect archaeological sites such as geomorphology, the formation of sites through geological processes and the effects on buried sites and artefacts.

Term	Definition
Glacial/Interglacial	A glacial period is a period of time within an ice age that is marked by colder temperatures and glacier advances. Interglacial correspond to periods of warmer climate between glacial periods. There are three main periods of glaciation within the last 1 million years, the Elsterian, the Saalian and the Weichselian which ended about 12,000 years ago. The Holocene period corresponds to the current interglacial.
Historic Seascape Character	The attributes that contribute to the formation of the historic character of the seascape
Inter-Platform Cables	Cables linking offshore platforms.
Marine Isotope Stage	Marine isotope stages are alternating warm and cool periods in the Earth's paleoclimate, deduced from oxygen isotope data reflecting changes in temperature derived from data from deep sea core samples.
Maritime Archaeology	The remains of boats and ships and archaeological material associated with prehistoric and historic maritime activities.
Mesolithic	10000 to 4000 BC The Middle Stone Age, falling between the Palaeolithic and Neolithic and marking the beginning of a move from a hunter gatherer society towards a food producing society.
Offshore Development Area	The Offshore Development Area encompasses the wind farm site and the options for the offshore transmission works.
Offshore Converter Platforms (OCPs)	Offshore Converter Platforms (OCPs) will be required for the HVDC option. The OCPs are fixed structures located within the array area that collect the AC power generated by the wind turbines and convert the power to DC, before transmission through the offshore export cables to the Project's onshore grid connection points.

Term	Definition
Offshore Development Area	The Offshore Development Area encompasses the wind farm site and the options for the offshore transmission works.
Offshore Export Cable Corridor	This is the area which will contain the offshore export cables (and potentially the ESP and / or RCP) between the offshore substation/converter platforms and Transition Joint Bays at the landfall
Offshore Substation Platforms (OSPs)	Offshore Substation Platforms (OSPs) will be required for the HVAC option. These are fixed structures located within the array areas that contain electrical equipment to aggregate the power from the wind turbines, followed by conversion into a more suitable voltage for transmission through the offshore export cables to the Project's onshore grid connection points.
Palaeoenvironmental Analysis	The study of sediments and the organic remains of plants and animals to reconstruct the environment of a past geological age.
Palaeogeographic Features	Features seen within sub-bottom profiler data (buried) and multibeam bathymetry data (sea floor) interpreted as representing prehistoric physical landscape features such as former river channels (palaeochannels).
Palaeolithic	500000 to 10000 BC The Old Stone Age defined by the practice of hunting and gathering and the use of chipped flint tools. This period is usually divided into Lower, Middle and Upper Palaeolithic.
Reactive Compensation Platform (RCP)	A Reactive Compensation Platform (RCP) will be required for a HVAC solution. The RCP will host the shunt reactors required to provide reactive compensation, in order to limit the electrical losses which occur with HVAC transmission over long distances.

Term	Definition
Scoping Opinion	The report adopted by the Planning Inspectorate on behalf of the Secretary of State.
Scoping Report	The report that was produced in order to request a Scoping Opinion from the Secretary of State.
Seabed Features	Features seen on the seafloor in the sidescan sonar or multibeam bathymetry data which are interpreted to represent heritage assets, or potential heritage assets. Also includes magnetic anomalies which may represent shallow buried ferrous material of archaeological interest.
Seabed Prehistory	Archaeological remains on the seabed corresponding to the activities of prehistoric populations that may have inhabited what is now the seabed when sea levels were lower.
The Applicant	RWE Renewables UK Dogger Bank South (West) Limited and RWE Renewables UK Dogger Bank South (East) Limited as the owners of DBS West and DBS East respectively are the named undertakers that will have the benefit of the Development Consent Order. References in this document to obligations on, or commitments by, 'the Applicant' are given on behalf of RWE Renewables UK Dogger Bank South (West) Limited and RWE Renewables UK Dogger Bank South (East) Limited.
The Projects	DBS East and DBS West (collectively referred to as the Dogger Bank South offshore wind farms).

Acronyms

Term	Definition
AEZ	Archaeological Exclusion Zones
BEIS	Department for Business, Energy and Industrial Strategy
BP	Before Present
CIfA	Chartered Institute of Archaeologists
CEA	Cumulative Effects Assessment
CHIA	Cultural Heritage Impact Assessment
CITiZAN	Coastal and Intertidal Zone Archaeology Network
DBS	Dogger Bank South
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
DEFRA	Department for the Environment, Food and Rural Affairs
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
GBS	Gravity Base Structure
GIS	Geographical Information System
HDD	Horizontal Directional Drilling

Term	Definition
HER	Historic Environment Record
HSC	Historic Seascape Characterisation
HVAC	High-Voltage Alternating Current
HVDC	High-Voltage Direct Current
IEMA	Institute of Environmental Management and Assessment
IHBC	Institute of Historic Building Conservation
IPMP	In-Principle Monitoring Plan
JNAPC	Joint Nautical Archaeology Policy Committee
ka	Kilo annum
km	Kilometre
LVIA	Landscape and Visual Impact Assessment
MBES	Multibeam Echosounder
MHWS	Mean High Water Springs
MHCLG	Ministry of Housing, Communities and Local Government
MLWS	Mean Low Water Springs
MIS	Marine Isotope Stage
MW	Megawatts
NHLE	National Heritage List for England
NRHE	National Record of the Historic Environment
NPPF	National Planning Policy Framework
NPS	National Policy Statement

Term	Definition
NSIP	Nationally Significant Infrastructure Project
ORPAD	Offshore Renewables Protocol for Archaeological Discoveries
OSP	Offshore Substation Platform
PEIR	Preliminary Environmental Information Report
ROV	Remotely Operated Vehicle
SBP	Sub-bottom Profiler
SSS	Side Scan Sonar
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UXO	Unexploded Ordnance
WSI	Written Scheme of Investigation

17 Offshore Archaeology and Cultural Heritage

17.1 Introduction

1. This chapter of the Preliminary Environmental Information Report (PEIR) considers the likely significant effects of the Projects on Offshore Archaeology and Cultural Heritage. The chapter provides an overview of the existing environment for the proposed Offshore Development Area, followed by an assessment of likely significant effects for the construction, operation, and decommissioning phases of the Projects.

2. The assessment should be read in conjunction with the following linked chapters:

   - **Chapter 8 Marine Physical Environment**; and
   - **Chapter 22 Onshore Archaeology and Cultural Heritage**.

17.2 Consultation

3. Consultation with regard to Offshore Archaeology and Cultural Heritage has been undertaken in line with the general process described in **Chapter 6 EIA Methodology**. The key elements of consultation to date have included scoping and the ongoing Evidence Plan Process (EPP) via the Historic Environment Expert Topic Group (ETG). The feedback received has been considered in preparing the PEIR. **Table 17-1** provides a summary of how the consultation responses received to date have influenced the approach that has been taken.

4. This chapter will be updated following consultation on PEIR in order to produce the final assessment that will be submitted with the Development Consent Order (DCO) application. Full details of the consultation process will also be presented in the Consultation Report alongside the DCO application.

Table 17-1 Consultation Responses

Comment	Project Response
Historic Environment ETG (Pre-Scoping) 15/09/2021	
Question on the present programme of primary data acquisition.	Marine geophysical survey data have been acquired and provided to Wessex Archaeology for archaeological assessment. This assessment is currently ongoing. The results will be discussed through the EPP with the Historic Environment ETG and will inform the Environmental Statement (ES). The process of site specific survey and assessment is discussed further in section 17.4.2.1.
The high level of coastal erosion has led to a number of 'lost villages' particularly south of Hornsea, which should be considered. The area under consideration has been subject to a research study by Humber Archaeology/Historic England to map wrecks and underwater features, the information would be pertinent to this work.	The archaeological potential relating to lost villages and the Rapid Coastal Zone Assessment for Yorkshire and Lincolnshire undertaken by Humber Archaeology are considered in section 17.5.3.
Question on survey work in 2022 and how geophysical and geotechnical work will be undertaken over such a large area.	Surveys were not undertaken at Scoping stage given the large size of the area. Following the completion of site selection, site specific surveys have been carried out and are currently undergoing assessment by Wessex Archaeology.
Question on historic seascape characterisation and how the changes that are occurring and likely to occur in the area will be taken into consideration. Historic England advocate an approach that defines and interprets changes to historic character.	The National Historic Seascape Characterisations has been used as the basis for the description of the historic seascape character in section 17.5.4 with consideration of how this has changed since compilation of the dataset.
Collaboration with other projects in the area is important, especially Sofia and the Dogger Bank projects.	Information from the Dogger Bank and Sofia projects is referenced where relevant with respect to the existing environment in section 17.5. Opportunities to integrate with wider assessments across the Dogger Bank will be explored as part of the CEA to

Comment	Project Response
	be carried out for the ES and discussed with stakeholders prior to the DCO submission.
The Crown Estate has recently re-published the Guide to Written Schemes of Investigation for Offshore Wind.	The updated guidance has been refenced within this PEIR and will form the basis for drafting an Outline (Offshore) Written Scheme of Investigation (WSI) to be submitted alongside the ES and DCO application.
Question on how the process of refining anomalies will be undertaken.	Wessex Archaeology have been contracted to undertaken the archaeological assessment of marine geophysical data and this will be further discussed through planned ETG meetings with Historic England.
Planning Inspectorate Scoping Opinion (02/09/2022)	
The Scoping Report describes the potential impacts to archaeological material resulting from changes in the hydrodynamic regime and sedimentary processes. The inter-relationship between the Marine Physical Processes assessment and the Offshore Archaeology and Cultural Heritage assessment should be explained in the ES, in particular how the assessments have informed each other where applicable	Inter-relationships between Offshore Archaeology and Cultural Heritage and Marine Physical Environment are described in section 17.11 and further described in sections 17.6.1.3, 17.6.2.3 and 17.6.3.3 as "Impact 3: Indirect impact to heritage assets from changes to physical processes".
The Scoping Report identifies the intention to carry out geophysical survey of the array areas and offshored export cable corridor(s) in 2022. The export cable corridor has not yet been fully defined and it will be essential for the ES to clearly set out the areas subject to this survey. Archaeological expertise should be used to inform the approach to geophysical assessment and the ES should also explain how stakeholder consultation has informed the data collection for the assessment The Inspectorate recommends that the Applicant makes effort to agree the survey methodology and the investigations needed	The approach to site specific surveys and archaeological assessment is set out in section 17.4.2.1. Marine geophysical and geotechnical data have been acquired from the Offshore Development Area by Fugro in 2022. Assessment of this data by specialist archaeological geophysicists at Wessex Archaeology is underway. Although the results are not yet available to inform the PEIR, the results will be communicated through the ETG meetings as part of the EPP and the full assessment results will inform the ES.

Comment	Project Response
to inform the assessment and any mitigation measures with the relevant consultation bodies including Historic England.	
The strategy for mitigation identified should be fully described in the ES, including the need for the application of Archaeological Exclusion Zones; and if required, details of the exclusion zones including the mechanism for securing them. The Inspectorate also advises that an archaeological Written Scheme of Investigation (WSI) should be produced, and effort made to agree it with consultation bodies, to enable the scope of archaeological investigation and mitigation to be determined and secured throughout the consenting process and post-consent.	The approach to embedded mitigation, including the application of AEZs is set out in section 17.3.3. Additional mitigation requirements are proposed in the relevant sections of the assessment of effects presented in section 17.6. The proposed approach to the delivery of mitigation post-consent, and how the outcomes of additional investigation will influence the final design of the Projects, will be set out in an Outline WSI (Offshore), which will be prepared in consultation with Historic England and in accordance with industry good practice guidance on Archaeological WSIs (The Crown Estate, 2021) and which will accompany the ES and DCO application.
The Inspectorate notes the intention in this section for archaeological involvement in geophysical and geotechnical survey work. The ES should describe how impacts to unknown assets, including paleogeographic deposits, that may be discovered would be mitigated and how the mitigation is to be secured.	Impacts to unknown assets are assessed in sections 17.6.1.2, 17.6.2.2 and 17.6.3.2. Planned geotechnical surveys will be subject to geoarchaeological assessment, including input into planning the surveys from a specialist marine geoarchaeologist. Geophysical data have been acquired and are currently being assessed by Wessex Archaeology. The proposed approach to the delivery of mitigation post-consent, and how the outcomes of additional investigation will influence the final design of the Projects, will be set out in the Outline WSI (Offshore).
Historic England Scoping Response 02/09/2022	
It is an important observation about the information presented in this EIA Scoping Report, that while an estimated diameter is offered for various foundation designs, it doesn't seem that estimates are provided	Indicative suction-bucket foundation penetration depths are provided in **Table 17-2** of this chapter. Gravity base foundations have been removed from the design envelope for turbine foundations, but may still be used for

Comment	Project Response
about depth of penetration of these designs into and beneath the contemporary seabed or wider area of seabed clearance required to support placement. Such detail is particularly relevant when considering impact as may arise from gravity base foundations and suction buckets.	the offshore platforms required for the Projects. Maximum potential areas for seabed preparation associated with these gravity based foundations are also included in **Table 17-2.** Updated specifications regarding penetration depths for such foundations will be provided in the final ES.
Section 2.1.3.1.2 (Effects on bedload sediment transport and seabed morphological change) – In reference to the statement about possible localised effects of construction associated with foundation and cable installation, it is directly relevant to consider the scale and magnitude of possible infrastructure to be placed on and within the contemporary seabed (e.g. as described in section 1.4.1.3). We therefore must consider the risk that this project may encounter geoarchaeological sedimentary evidence of considerable importance and crucial to our understanding about paleoclimatic change. Furthermore, until demonstrated otherwise through geophysical and geotechnical survey work, it is reasonable to consider that such sedimentary sequences and evidence of prehistoric landscape features exist within the proposed development area (as described within Section 2.13).	The potential for submerged prehistoric landscapes is described in section 17.5.1 informed by preliminary geotechnical survey. Further planned geotechnical surveys will be subject to geoarchaeological assessment, including input into planning the surveys from a specialist marine geoarchaeologist. Geotechnical surveys within the offshore export cable corridor are currently planned for 2023 and within the array areas during 2024. Site specific geophysical data have been acquired and are currently being assessed by Wessex Archaeology. The results will be further discussed through planned ETG meetings with Historic England and will inform the ES.
Section 2.1 (Marine Physical Processes) – it is our advice that changes, as proposed by this project arising from 'construction' should be considered as likely to give rise to significant impacts on seabed features and morphology. In reference to the explanation provided about mitigation (section 1.7.2.4) it is a relevant matter that the applicant demonstrates a "commitment" to conduct geophysical, geotechnical survey and other seabed intrusive investigations,	The effects of construction upon marine physical processes are discussed in **Chapter 8 Marine Physical Environment**. Geotechnical survey data planned for acquisition in 2023 and 2024 will be subject to geoarchaeological assessment. Input into the planning of these surveys will be provided by a specialist marine geoarchaeologist. Geophysical data have been acquired and are currently being assessed by Wessex Archaeology. The results will be further discussed through planned ETG meetings with Historic England and will inform the ES.

Comment	Project Response
as part of the preparation of any Environmental Statement (ES) produced for this proposed project.	
"Do you agree with the characterisation of the existing environment?" The text provides a general description of the area in which these developments are proposed, but such limited detail cannot be considered to offer "characterisation". In reference to figure 2-24 we noted in the key "Historic Wreck", but it was not possible to identify such features in the figure due to the density of other symbology. We also offer the comment that careful consideration should be given to the use of the term "historic wreck" and that attention should be given to how heritage assets (whether designated or not designated) are addressed through the UK Marine Policy Statement and the subsequently published Marine Plan policy for cultural heritage.	A full desk-based assessment of the existing environment for Offshore Archaeology and Cultural Heritage is provided in section 17.5. The National Policy Statements (NPS), UK Marine Policy Statement and the published Marine Plan policy for cultural heritage have been taken into account in establishing the existing environment.
"Do you agree with the approach to data collection?" Table 2-33 (Site-Specific Data) only offers some certainty that geophysical survey will be conducted (as described in paragraph 486), but we recommend that to attempt to characterise the areas subject to these proposed developments, it is relevant that geotechnical investigations are commissioned and conducted as part of any programme of work to prepare an ES. In addition, while we concur that archaeological advice is essential to inform the planning of such surveys (paragraph 487), it is inadequate and likely to be of very limited value to any party to simply mention that "…samples will be made available for geoarchaeological assessment."	Planned geotechnical surveys will be subject to geoarchaeological assessment, including input into planning the surveys from a specialist marine geoarchaeologist. Geotechnical surveys within the offshore export cable corridor are currently planned for 2023 and a geoarchaeological assessment of the geotechnical logs will inform the ES. Geotechnical surveys within the array areas are planned for 2024 and geoarchaeological assessment will be undertaken post-submission. Geophysical data have been acquired and are currently being assessed by Wessex Archaeology. The results will be further discussed through planned ETG meetings with Historic England and will inform the ES.

Comment	Project Response
"Have all the potential impacts on Offshore Archaeology and Cultural Heritage resulting from the Projects been identified in the Scoping Report?" Theoretical impacts based on a multitude of possible engineering designs for these proposed developments appear to have been outlined, as relevant to the preparation of an EIA Scoping report. For example, section 2.13.3 (Potential Impacts), paragraph 490, highlights an important matter regarding how impacts may occur if heritage assets are located, or otherwise discovered, within the footprint of the proposed developments and / or from construction activities such as seabed clearance and anchoring.	Noted.
"Do you agree with the impacts that have been scoped in (or scoped out) of further assessment?" We concur that all potential impacts during anticipated phases of construction, operation and maintenance and decommissioning operations are scoped in (as explained within sections 2.13.3.1 to 2.13.3.3). We also concur that potential cumulative impacts (section 2.13.3.4) and potential direct transboundary impacts (section 2.13.3.5) are both scoped in.	Noted.
"Do you agree with the proposed approach to assessment?" In reference to the summary of possible impacts that are scoped in (as summarised in Table 2-34), it is our advice that the strategy of mitigation (as mentioned in paragraph 515) is expanded to include dealing with situations whereby avoidance is not possible, such as tolerances for micro-sit-	Additional mitigation measures detailed in the impact assessment (section 17.6) comprise: • Geoarchaeological assessment; • Archaeological assessment of further geophysical data to be acquired post-consent; • Refinement of the design of offshore infrastructure post consent to avoid

Comment	Project Response
ing / positioning given the range of foundation designs under consideration. Subsequent stages of preparing the DCO application for these proposed projects should therefore include the preparation of an accompanying (outline) archaeological Written Scheme of Investigation to detail the methodological approach and techniques to be employed for high-resolution survey and possible intrusive investigation and recovery. It is also relevant that the ES explains the methodological approach which underpins an effective mitigation programme based on geo-archaeological processing of survey data. It is therefore important that research questions are included as informed by the North Sea Prehistory Research and Management Framework (H. Peeters *et al.* 2009) and People and the Sea: a maritime archaeological research agenda for England (J. Ransley *et al.* 2013).	Archaeological Exclusion Zones (AEZs) and additional geophysical anomalies of potential archaeological interest (where possible); • Further investigation where avoidance is not possible and additional mitigation to reduce or offset impacts should impacts be unavoidable; and • Implementation of a protocol for archaeological discoveries to address unexpected discoveries which might be encountered during the course of planned activities. A proposed approach to the delivery of this additional mitigation, post-consent, and how the outcomes of additional investigation will influence the final design of the Projects, will be set out in an Outline WSI (Offshore) which will be prepared in accordance with industry good practice guidance on Archaeological WSIs (The Crown Estate, 2021) and which will accompany the ES and DCO application. This will include reference to current, relevant research agendas.
The following references should also be used to inform the subsequent stages of preparing a Preliminary Environmental Information Report and eventual ES: • Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects, published by The Crown Estate (2021); • Protocol for Archaeological Discoveries: Offshore Renewables Projects, published by The Crown Estate (2014); and	References are included at the end of this chapter.

Comment	Project Response
• Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector, published by COWRIE (2011)	
Section 2.14 (Seascape, Landscape and Visual Impact) – paragraph 520 and Figure 5-25, explain and show the distribution of offshore wind farm developments (at various stages of planning and delivery). It is therefore an important matter that the attention given to the historic environment (as alluded to in paragraph 521) cross-references with the assessment of Historic Seascape Characterisation (as mentioned briefly in 2.13.3.1, paragraph 496). However, we consider the matter that requires assessment in the ES is the constructed presence of offshore wind farms (as described in section 1.4.1.2) rather than the "potential for temporary impacts to the setting" associated with the presence of vessels during the construction phase(s).	Potential changes to the historic seascape character are outlined in section 17.5.4.
It is important to take account of the methodological approach for determining historic character, which is based on perception and is not necessarily dependent on consideration of visibility. The key fact is how disparate data allows for consideration of perceptions of character based on different activities and environmental change over time and how such definable characteristics (in different dimensions) can accommodate change. It therefore seems that the position adopted, for example, Section 2.14.3.2 (Potential impacts during operation), paragraph 526 and 2.14.3.4 (Potential cumulative impacts), paragraph 530 and summarised in Table 2-35, will not allow for a full assessment of how seascape is perceived and how proposed changes can be accommodated, as	Potential changes to the historic seascape character are outlined in section 17.5.4.

Comment	Project Response
a component part of any ES subsequently produced.	

17.3 Scope

17.3.1 Study Area

5. The offshore archaeology and cultural heritage study area (referred to as the offshore archaeology study area) is defined as the Offshore Development Area, including the intertidal zone at the landfall up to Mean High Water Springs (MHWS) (**Figure 5-1**). The offshore archaeology study area corresponds to the footprint within which development activities could occur and, consequently, the area of potential impacts to the Offshore Archaeology and Cultural Heritage existing environment.

6. At the landfall, areas of the Onshore Development Area which are located below MHWS are also included in the offshore archaeology study area. These areas correspond to emergency access routes through the intertidal zone, should these be required.

17.3.2 Realistic Worst Case Scenario

17.3.2.1 General Approach

7. The realistic worst case design parameters for likely significant effects scoped into the EIA for the Offshore Archaeology and Cultural Heritage assessment are summarised in **Table 17-2**. These are based on the project parameters described in **Chapter 5 Project Description**, which provides further details regarding specific activities and their durations.

8. In addition to the design parameters set out in **Table 17-2**, consideration is also given to the different development scenarios still under consideration and the possible phasing of the construction as set out in sections 17.3.2.2 to 17.3.2.5.

9. The worst case scenario for archaeology below MHWS is based upon the general assumption that the greatest potential footprint for the Projects represents the greatest potential for direct impacts (e.g. damage / destruction) to surviving archaeological material which could be present on the sea floor or buried within seabed deposits.

10. The worst case scenario for indirect impacts equates to those aspects of the Projects which result in the greatest potential for increased scour and sediment stripping across an area as a result of changes to physical processes. Conversely, those aspects of the Projects which result in the greatest increase in sediment deposition also represent the greatest potential effect in terms of the beneficial impact of increased protection for archaeology.

11. With regard to historic seascape character, the worst case scenario is considered in terms of the capacity for the seascape to accommodate change. Whilst **Table 17-2** makes reference to the maximum intrusive effect (e.g. number and type of new infrastructure elements, height of infrastructure etc.) for the longest duration (i.e. the maximum potential change), this is further qualified by the narrative description provided in section 17.5.4.

Table 17-2 Realistic Worst Case Design Parameters

	Parameter			
	DBS East in isolation (HVDC only)	**DBS West in isolation (HVAC only)**	**DBS West and DBS East concurrently and / or in sequence (HVAC + HVDC)**	**Notes and rationale**
Construction In the instance of **sequential** development of the two Projects, up to a **2 year lag** between construction activities is possible, final overall footprint would be **identical** to the **concurrent** design scenario.				
Impact 1: Direct (physical) impact to known heritage assets Impact 2: Direct impact to potential heritage assets	Total developable array area – 494.5km² Total disturbance within Array Areas – 8,804,077m² (Array and inter-platform cable trenching, sandwave levelling, foundation installation and vessel impacts) Total temporary area disturbed for export cable installation (trenching, sandwave levelling, anchoring and foundation installation) – 9,206,411m²	Total developable array area – 494.5km² Total disturbance within Array Areas – 9,706,077m² (Array and inter-platform cable trenching, sandwave levelling, foundation installation and vessel impacts) Total temporary area disturbed for export cable installation (trenching, sandwave levelling and anchoring) – 15,523,443m²	Total developable array area – 989km² Total disturbance within Array Areas – 23,236,305m² (Array and inter-platform cable trenching, sandwave levelling, foundation installation and vessel impacts) Total temporary area disturbed for export cable installation (trenching, sandwave levelling and anchoring) – 24,729,838m²	The worst case scenario represents the maximum area of disturbed seabed sediments with the potential for archaeological material to be present either on the seafloor or buried within seabed deposits.
	Cables <u>Array Area and Inter-platform Cables</u> Array cable trench area (325km x 18m jetting disturbance width) – 5,850,000m² Inter-platform cable trench area (55km x 18m disturbance width) – 990,000m²	**Cables** <u>Array Area and Inter-platform Cables</u> Array cable trench area (325km x 18m jetting disturbance width) – 5,850,000m² Inter-platform cable trench area (99km x 18m disturbance width) – 1,782,000m²	**Cables** <u>Array and Inter-platform Cables</u> Array cable trench area (650km x 18m jetting disturbance width) – 11,700,000m² Inter-platform cable trench (385km x 18m disturbance width) – 6,930,000m²	Assumes even split of the total 650km array cable length between DBS East and DBS West. Pre-lay grapnel run (PLGR) activities will fall within the footprint of the cable trench disturbance width of 18m.

	Parameter			
	DBS East in isolation (HVDC only)	**DBS West in isolation (HVAC only)**	**DBS West and DBS East concurrently and / or in sequence (HVAC + HVDC)**	**Notes and rationale**
	Maximum seabed footprint disturbed by sandwave levelling – 950,000m² Maximum sandwave material to be dredged and relocated – 384,750m³ Maximum area disturbed – 7,790,000m² <u>Offshore Export Cable Corridor</u> Total offshore cable length per circuit –198km Number of cable circuits required – two Max. offshore cable length for all cable circuits – 396km Note – Assuming two separate cable trenches, for each cable circuit, 50m apart, Maximum temporary disturbance for cable installation – 7,128,000m² (based on 396km distance x 18m width of temporary disturbance) Maximum seabed footprint disturbed by sandwave levelling – 2,047,002m² Maximum sandwave material to be dredged and relocated – 33,121,800m³	Note –DBS West High Voltage Alternating Current (HVAC) built in isolation would require inter-platform cables between the four offshore substation platforms (OSPs) required. Maximum seabed footprint disturbed by sandwave levelling – 1,060,000m² Maximum sandwave material to be dredged and relocated – 429,300m³ Maximum area disturbed – 8,692,000m² <u>Offshore Export Cable Corridor</u> Total offshore cable length per circuit – 158km Number of cable circuits required – four Max. offshore cable length for all cable circuits – 632km Note – Assuming four separate cable trenches, for each cable circuit, 50m apart, Maximum temporary disturbance for cable installation – 11,376,000m² (based on 632km distance x 18m width of temporary disturbance)	Note – Concurrent design assumes HVAC + High Voltage Direct Current (HVDC) design scenario as the worst case. Requires inter-platform cables between the Projects to connect the OSPs, hence the increase from 99km to 385km. Maximum seabed footprint disturbed by sandwave levelling – 2,587,500m² Maximum sandwave material to be dredged and relocated – 1,047,938m³ Maximum area disturbed – 21,217,500m² Offshore Export Cable Corridor Total offshore cable length per circuit – 198km for DBS East, 158km for DBS West. Number of circuits required – six Max. offshore cable length for all cables – 1,028km Note – Assuming 6 separate cable trenches, for each cable circuit, 50m apart, Maximum temporary disturbance for cable installation – 18,504,000m²	Two export cable circuits required for HVDC, up to four required for HVAC. Maximum export cable length assumes worst case that cable circuits are laid and buried in separate trenches rather than bundled.

	Parameter			
	DBS East in isolation (HVDC only)	**DBS West in isolation (HVAC only)**	**DBS West and DBS East concurrently and / or in sequence (HVAC + HVDC)**	**Notes and rationale**
	Maximum total impacted area by anchoring – 22,061m² Note – 10km stretch along the offshore export cable corridor <10m Lowest Astronomical Tide (LAT), may require use of anchoring Total temporary area disturbed for export cable installation (trenching, sandwave levelling and anchoring) – 9,197,063m²	Maximum seabed footprint disturbed by sandwave levelling – 4,094,003m² Maximum sandwave material to be dredged and relocated – 66,243,600m³ Maximum total impacted area by anchoring – 44,091m² Note – 10km stretch along the offshore export cable corridor <10m LAT, may require use of anchoring Total temporary area disturbed for export cable installation (trenching, sandwave levelling and anchoring) – 15,514,094m²	(based on 1028km distance x 18m width of temporary disturbance) Maximum seabed footprint disturbed by sandwave levelling – 6,141,005m² Maximum sandwave material to be dredged and relocated – 99,365,402m³ Maximum total impacted area by anchoring – 66,136m² Note – 10km stretch along the offshore export cable corridor <10m LAT, may require use of anchoring Total temporary area disturbed for export cable installation (trenching, sandwave levelling and anchoring) – 24,711,141m²	
	Foundations and Vessel Impacts <u>Array Areas</u> Seabed footprint for 100 small wind turbine suction bucket jacket foundations – 70,686m² Four offshore converter platforms (OCP) Gravity Based Structure (GBS) and one accommodation platform	**Foundations and Vessel Impacts** <u>Array Areas</u> Seabed preparation area for 100 small turbine suction bucket jacket foundations – 70,686m² Four OSP foundations (HVAC only, GBS foundation) and one accommodation platform – 19,242m²	**Foundations and Vessel Impacts** <u>Array Areas</u> Seabed preparation area for 200 small turbine suction bucket jacket foundations – 141,372m² Eight offshore (OSP/OCP) platforms GBS seabed preparation (HVAC + HVDC) and one accommodation platform – 34,636m²	In situations where a number does not divide equally between DBS East and DBS West (e.g. 95 large turbines), rounded up to higher number (e.g. 48 large turbines as opposed to 47.5). While the seabed footprint for the large turbine scenario is greater than that of the small turbine scenario, due to the increased vessel jack-up and anchoring

	Parameter			
	DBS East in isolation (HVDC only)	**DBS West in isolation (HVAC only)**	**DBS West and DBS East concurrently and / or in sequence (HVAC + HVDC)**	**Notes and rationale**
	seabed preparation (HVDC only) – 19,242m² Vessel jack-up assuming six jack-up locations per turbine (275m² per jack up leg x four legs x six operations per turbine x 100 small turbines) – 660,000m² Vessel jack-up footprint for all platforms (1,100m² combined leg area x five operations per platform x five platforms) – 27,500m² Anchoring (116m² footprint x four anchors per activity x five activities requiring the deployment of anchors x 100 small turbines) – 232,000m² Maximum area disturbed in array areas – 1,010,228m² <u>Offshore Export Cable Corridor</u> Electrical Switching Platform (ESP) foundation (HVDC only, GBS foundation) - 3,848m² Vessel jack-up footprint for all platforms –5,500m² Total area disturbed by offshore platform installation activities within	Note – HVAC project in isolation requires four OSPs. Two other platform foundations (Reactive Compensation Platform (RCP) + Accommodation Platform) (HVAC only, GBS foundation) - 7,697m² Note – HVAC project in isolation requires a RCP accommodation platform, HVDC in-isolation does not require an RCP Vessel jack-up assuming six jack-up locations per turbine (275m² per jack up leg x four legs x six operations per turbine x 100 small wind turbines) – 660,000m² Vessel jack-up footprint for all platforms (1100m² combined leg area x five operations per platform x five platforms) – 33,000m² Anchoring (116m² footprint x four anchors per activity x five activities requiring the deployment of anchors x 100 small wind turbines) – 232,000m² Maximum area disturbed – 1,00,228m²	Note – HVAC/HVDC Solution = four HVAC + four HVDC = eight platforms on GBS Vessel jack-up assuming six jack-up locations per turbine (275m² per jack up leg x four legs x six operations per turbine x 200 small wind turbines) – 1,320,000m² Vessel jack-up footprint for all platforms (1,100m² combined leg area x five operations per platform x nine platforms) – 60,500m² Anchoring (1,16m² footprint x four anchors per activity x five activities requiring the deployment of anchors x 200 small wind turbines) – 464,000m² Maximum area disturbed – 2,011,108m² <u>Offshore Export Cable Corridor</u> ESP + RCP GBS foundations – 7,697m² Vessel jack-up footprint for all platforms – 11,000m² Total area disturbed by offshore platform installation activities within	footprint required for the greater number of turbines the small turbine scenario has a greater seabed footprint. 1 project HVDC Solution = 2 platforms on GBS (or 4 platforms on other foundation types) Anchoring events assumes 4 activities per turbine foundation installation + 1 activity for topside installation per turbine.

	Parameter			
	DBS East in isolation (HVDC only)	**DBS West in isolation (HVAC only)**	**DBS West and DBS East concurrently and / or in sequence (HVAC + HVDC)**	**Notes and rationale**
	the offshore export cable corridor – 9,348m²	Offshore Export Cable Corridor Reactive Compensation Platform (RCP) foundation (HVDC only, GBS foundation) - 3,848m² Vessel jack-up footprint for all platforms –5,500m² Total area disturbed by offshore platform installation activities within the offshore export cable corridor – 9,348m²	the offshore export cable corridor – 18,697m²	
	Scour/Cable Protection and Crossings Array Area Total worst case turbine footprint with scour protection - 2,667,456m² (48 large turbines x 55,572m² total protection per turbine) Total worst case scour protection for OCPs and other platforms in array areas – 282,052m² Total array and inter-platform cable protection – 656,512 (488,400m² array cable protection + 168,112 inter platform cable protection)	**Scour/Cable Protection and Crossings** Array Area Total worst case turbine footprint with scour protection - 2,667,456m² (48 large turbines x 55,572m² total protection per turbine) Total worst case scour protection for OSPs and other platforms – 282,052m² Total array and inter-platform cable protection - 790,515m² (488,400m² array cable protection + 302,115m² inter-platform cable protection)	**Scour/Cable Protection and Crossings** Array Areas Total worst case turbine footprint with scour protection – 5,279,340m² (95 large turbines x 55,572m² total protection per turbine) Total worst case scour protection for OSP/OCPs and other platforms – 507,694m² Total array and inter-platform cable protection - 2,139,904m² (976,800m² array cable protection + 1,163,104m² inter-platform cable protection)	

	Parameter			
	DBS East in isolation (HVDC only)	**DBS West in isolation (HVAC only)**	**DBS West and DBS East concurrently and / or in sequence (HVAC + HVDC)**	**Notes and rationale**
	Total footprint of pipeline / cable crossing material (array cables) – 61,310m² Total area – 3,667,330m² Offshore Export Cable Corridor Total offshore export cable protection – 1,089,660m² Total worst case scour protection for ESP in offshore export cable corridor – 56,410m² Total footprint of pipeline and / or cable crossing material – 122,611m² Total area – 1,268,681m²	Total footprint of pipeline / cable crossing material (array + inter–platform cables) – 73,539m² *Note - Four predicted inter-platform cable crossings for HVAC only scenario.* Total area – 3,813,562m² Offshore Export Cable Corridor Total offshore export cable protection – 1,642,872m² Total worst case scour protection for RCP in offshore export cable corridor – 56,410m² Total footprint of pipeline / cable crossing material – 294,267m² Total area – 1,993,549m²	Total footprint of pipeline / cable crossing material (array + inter–platform cables) - 244,915m² Total area – 8,171,853m² Offshore Export Cable Corridor Total offshore export cable protection – 2,701,040m² Total worst case scour protection for ESP & RCP in offshore export cable corridor – 112,821m² Total footprint of pipeline and / or cable crossing material – 441,400m² Total area – 3,255,261m²	
	Landfall No. of horizontal directional drills (HDDs) – Five Indicative depth of water at drill exit – 8m Indicative HDD length – 1400m	**Landfall** No. of HDDs – Five Indicative depth of water at drill exit – 8m Indicative HDD length – 1400m Exit pits may be located within the intertidal area	**Landfall** No. of HDDs – Nine Indicative depth of water at drill exit – 8m Indicative HDD length – 1400m Exit pits may be located within the intertidal area	Total HDD number includes one spare for the in isolation scenarios, and two spare for the concurrent/sequential scenario.

	Parameter			
	DBS East in isolation (HVDC only)	**DBS West in isolation (HVAC only)**	**DBS West and DBS East concurrently and / or in sequence (HVAC + HVDC)**	**Notes and rationale**
	Exit pits may be located within the intertidal area			
Impact 3: Indirect impact to heritage assets from changes to physical processes	The worst case scenarios for marine physical processes are set out in **Chapter 8 Marine Physical Environment** (**Table 8-3**). The following impacts are relevant to the worst case for Offshore Archaeology and Cultural Heritage (i.e. increased exposure of buried archaeological material to marine processes due to loss of sediment cover): Impact C3: Changes to bedload sediment transport due to HDD exit cable installation; and Impact C4: Indentations on the seabed due installation vessels. Conversely, marine physical processes impacts which correspond to increased bed-level and consequent increased potential for the protection of heritage assets which are currently exposed through additional sediment cover (sediment deposited from plume) are: Impact C2a: Changes to seabed level due to seabed preparation for foundation installation; Impact C2b: Changes to seabed level due to drill arisings from foundations; and Impact C2c: Changes to seabed level due to array, inter platform and offshore export cable installation.			
Impact 4: Impacts to the setting of heritage assets	Maximum duration of offshore construction: 5 years Up to 66 construction vessels on-site simultaneously and up to 5,745 round trips to port.	Maximum duration of offshore construction: 5 years Up to 132 construction vessels on-site simultaneously and up to 11,489 round trips to port.	Maximum duration of offshore construction: 5 years Up to 132 construction vessels on-site simultaneously and up to 11,489 round trips to port.	The worst case scenario represents the maximum intrusive effect of construction activities for the longest duration. If built non-concurrently, it is anticipated that there would be up to a two year lag between the start of construction for the first project and the start of construction for the second project. Taking the above into account, the maximum construction period over which the

	Parameter			
	DBS East in isolation (HVDC only)	**DBS West in isolation (HVAC only)**	**DBS West and DBS East concurrently and / or in sequence (HVAC + HVDC)**	**Notes and rationale**
				construction of both Projects could take place is seven years.
Operation				
Impact 1: Direct (physical) impact to known heritage assets Impact 2: Direct impact to potential heritage assets	**Array Area** Seabed disturbance from jacking-up activities over Projects lifetime – 306,900m² (10,230m² per year x 30 year lifespan) *Note- 10,230m² is half of total 20,460m² area disturbed per year for 200 turbines)* Array cable repairs - seabed disturbance over Projects lifetime – 42,000m² (7 events x 6,000m² per event) **Export Cable Route** Export cable repairs - seabed disturbance over Projects lifetime – 18,000m² (3 events x 6,000m² per event)	**Array Area** Seabed disturbance from jacking-up activities over Projects lifetime – 306,900m² (10,230m² per year x 30 year lifespan) *Note- 10,230m² is half of total 20,460m² area disturbed per year for 200 turbines)* Array cable repairs - seabed disturbance over Projects lifetime – 42,000m² (7 events x 6,000m² per event) **Export Cable Route** Export cable repairs - seabed disturbance over Projects lifetime – 18,000m² (3 events x 6,000m² per event)	**Array Areas** Seabed disturbance from jacking-up activities over Projects lifetime – 613,800m² (20,460m² per year x 30 year lifespan) Array cable repairs - seabed disturbance over Projects lifetime – 78,000m² (13 events x 6,000m² per event) **Export Cable Route** Export cable repairs - seabed disturbance over Projects lifetime – 36,000m² (6 events x 6,000m² per event)	The worst case scenario represents the maximum area of disturbed seabed sediments with the potential for archaeological material to be present either on the seafloor or buried within seabed deposits. Assumes impacts will be less than for construction (i.e. for maintenance activities within the same footprint, impacts would already have occurred during construction)
	Landfall All cables will be buried below landfall, assumed no maintenance activities required during the operational stage. As such no operational impacts predicted to occur at landfall.			

	Parameter			
	DBS East in isolation (HVDC only)	**DBS West in isolation (HVAC only)**	**DBS West and DBS East concurrently and / or in sequence (HVAC + HVDC)**	**Notes and rationale**
Impact 3: Indirect impact to heritage assets from changes to physical processes	The worst case scenarios for marine physical processes are set out in Chapter 6 Marine Physical Processes (Table 8-2). The following impacts are relevant to the worst case for Offshore Archaeology and Cultural Heritage: Impact O1: Changes to the tidal regime due to the presence of infrastructure (wind turbines and offshore platforms); Impact O2: Changes to the wave regime due to the presence of infrastructure (wind turbines and offshore platforms); Impact O4a: Changes to bedload sediment transport and seabed morphology due to the presence of infrastructure (wind turbines and offshore platforms); Impact O4b: Changes to bedload sediment transport and seabed morphology due to the presence of cable protection measures; Impact O5: Cable repairs and reburial; and Impact O8: Indentations on the seabed due to installation vessels.			The worst case scenario represents the greatest potential for increased scour and sediment stripping across an area as a result of changes to physical processes which could result in the exposure and degradation of heritage assets which are currently buried and protected from marine processes.
Impact 4: Impacts to the setting of heritage assets	**Presence of wind farm infrastructure:** Up to 100 wind turbines 6 platforms in the DBS East array area and offshore export cable corridor **Maximum temporal footprint:** The operational lifetime is expected to be 30 years **Vessels** Maximum number of O&M vessels on site at any one time – 11	**Presence of wind farm infrastructure:** Up to 100 wind turbines 6 platforms in the DBS West array area and offshore export cable corridor **Maximum temporal footprint:** The operational lifetime is expected to be 30 years **Vessels** Maximum number of O&M vessels on site at any one time – 11	**Presence of wind farm infrastructure:** Up to 200 wind turbines Up to 11 platforms within array areas and offshore export cable corridor **Maximum temporal footprint:** The operational lifetime is expected to be 32 years **Vessels** Maximum number of O&M vessels on site at any one time – 21	The worst case scenario represents the maximum intrusive effect of installed infrastructure and operation and maintenance activities for the longest duration. Based on simultaneous presence of jack-up vessels, service operations vessels, accommodation vessels, small CTV vessels, lift vessels, cable maintenance vessels and auxiliary vessels.

	Parameter			
	DBS East in isolation (HVDC only)	**DBS West in isolation (HVAC only)**	**DBS West and DBS East concurrently and / or in sequence (HVAC + HVDC)**	**Notes and rationale**
	Up to 473 annual round trips to port.	Up to 473 annual round trips to port.		
Decommissioning				
No final decision regarding the final decommissioning policy for the onshore project infrastructure including landfall, onshore cable route and onshore substation has yet been made. It is also recognised that legislation and industry best practice change over time. However, it is likely that offshore project infrastructure will be removed above the seabed and reused or recycled where practicable. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and will be agreed with the regulator. It is anticipated that for the worst case scenario, the impacts will be no greater than those identified for the construction phase.			

17.3.2.2 Development Scenarios

12. There are currently two possible electrical solutions being considered for DBS West, HVAC or HVDC. Due to the distance of the array area offshore DBS East will be an HVDC project. Therefore, there are two possible electrical solutions for the Projects:

- One HVDC project and one HVAC project; or
- Two HVDC projects.

13. Offshore the most significant difference between an HVAC solution and an HVDC solution is that if an HVAC electrical solution is used an additional platform (reactive compensation platform (RCP)) will be required along the offshore export cable. In addition, a HVAC solution will require two additional export cables, over and above the four export cables that would be required for two HVDC projects.

14. In order to ensure that a robust assessment has been undertaken, all development scenarios and options have been considered to ensure the realistic worst case scenario for each topic has been assessed. Further details are provided in **Chapter 5 Project Description**.

17.3.2.3 Construction Scenarios

15. The following principles set out the framework for how the Projects may be constructed (relating to both onshore and offshore works):

- DBS East and DBS West may be constructed at the same time, or at different times;
- If built concurrently, both Projects could be constructed in five years;
- If built non-concurrently, either Project could be built first;
- If built non-concurrently, each Project would require a five year period of construction;
- If built non-concurrently, it is anticipated that there would be up to a two year lag between the start of construction for the first project and the start of construction for the second project; and
- Assuming a maximum construction period per Project of five years, and taking the above into account, the maximum construction period over which the construction of both Projects could take place is seven years.

16. In order to determine which construction scenario presents the realistic worst case for each receptor and impact, the assessment considers both maximum duration effects and maximum peak effects, in addition to each Project being developed in isolation, drawing out any differences between each of the two Projects.

17. The three construction scenarios considered by the Offshore Archaeology and Cultural Heritage assessment are therefore:

- Build DBS East or build DBS West in isolation;
- Build DBS East and DBS West concurrently – reflecting the maximum peak effects; and
- Build the Projects sequentially with a lag of up to two years – reflecting the maximum duration of effects.

18. The individual, concurrent and sequential construction scenarios all allow for flexibility to build out the Projects using a phased approach. This will allow the Projects to adapt to National Grid Electricity Transmission Operator's development plans for the onshore grid connection points. Under a phased approach the maximum timescales for individual elements of the construction have been assessed.

19. Any differences between the Projects, or differences that could result from the manner in which the first and the second Projects are built (concurrent or sequential and the length of any gap) are identified and discussed where relevant in section 17.6. For each potential impact, only the worst case construction scenario for two Projects is presented, i.e. either concurrent or sequential. The justification for what constitutes the worst case is provided, where necessary, in section 17.6.

17.3.2.4 Operation Scenarios

20. Operation scenarios are described in detail in **Chapter 5 Project Description**. The assessment considers the following scenarios:

- Only DBS East in operation;
- Only DBS West in operation; and
- The two Projects operating concurrently, with a lag of two years between each Project commencing operation.

21. If the Projects are built out using a phased approach, there would also be a phased approach to starting the operational stage. The worst case scenario for the operational phases for the Projects have been assessed. See section 5.1.1 of **Chapter 5 Project Description** for further information on phasing scenarios for the Projects.

22. The operations lifetime of each Project is expected to be 30 years.

17.3.2.5 Decommissioning Scenarios

23. Decommissioning scenarios are described in **Chapter 5 Project Description**. Decommissioning arrangements will be agreed through the submission of a Decommissioning Programme prior to construction, however for the purpose of this assessment it is assumed that decommissioning of the Projects could be conducted separately, or at the same time.

17.3.3 Mitigation Embedded in the Design

24. This section outlines the embedded mitigation relevant to the Offshore Archaeology and Cultural Heritage assessment, which has been incorporated into the design of the Projects (**Table 17-3**). Where other mitigation measures are proposed, these are detailed in the impact assessment (section 17.6).

Table 17-3 Embedded Mitigation Measures

Parameter	Mitigation Measures Embedded into the Project Design
Wrecks (Maritime and Aviation Archaeology)	A requirement to avoid historic wrecks (as far as possible) was included as a design principal for site selection in the design of the offshore cable corridor.

25. AEZs are recommended around the extents of known wreck sites, marine geophysical anomalies of archaeological interest and previously recorded sites at which the presence of surviving material is considered possible. No development related activities will take place within an AEZ.

26. However, while the assessment of site specific marine geophysical data by specialist archaeological geophysicists at Wessex Archaeology is underway, the results are not yet available. The nature and extent of AEZs, therefore, will be established following completion of the archaeological assessment, and the results will be presented in the ES. Similarly, the distribution of further features of possible archaeological interest, as seen in the geophysical data, will also be identified in the ES.

27. The avoidance of AEZs, and features of possible archaeological interest, has not been embedded in the design of the wind farm boundaries or offshore cable corridors to date (over and above the requirement to avoid historic wrecks as far as possible as a principal of site selection). However, the parameters of the Projects are sufficiently wide to accommodate micro-siting as part of the cable route refinement and wind farm design (which will be progressed post consent).

28. A proposed approach to the delivery of mitigation post-consent, and how the outcomes of additional investigation will influence the final design of the Projects, will be set out in an Outline WSI (Offshore), which will be prepared in accordance with industry good practice guidance on Archaeological WSIs (The Crown Estate, 2021) and which will accompany the ES and DCO application.

17.4 Assessment Methodology

17.4.1 Policy, Legislation and Guidance

17.4.1.1 National Policy Statements

29. The assessment of potential impacts upon Offshore Archaeology and Cultural Heritage has been made with specific reference to the relevant NPS. The specific assessment requirements for Offshore Archaeology and Cultural Heritage, as detailed in the NPS, are summarised in **Table 17-4** together with an indication of the section of this chapter where each is addressed.

30. It is noted that the NPS for Energy (EN-1), the NPS for Renewable Energy Infrastructure (EN-3) and the NPS for Electricity Networks Infrastructure (EN-5) are in the process of being revised. Draft versions were published for consultation in September 2021 by the Department for Business, Energy and Industrial Strategy (BEIS) (2021a, 2021b and 2021c respectively). A review of these draft versions has been undertaken in the context of this PEIR chapter. Any further changes to these draft revisions resulting from the consultation process will be considered in the ES.

31. Following the consultation in 2021 on the draft energy NPS, a new consultation opened on the 30th March 2023 on revised drafts of the energy NPSs, including EN1, EN3 and EN5. Due to the timing of this consultation, and finalisation of this PEIR we have been unable to review and take these revised draft NPS into account within these documents. However, these will be reviewed and incorporated into the final ES where relevant.

Table 17-4 NPS Assessment Requirements

NPS Requirement	NPS Reference	PEIR Section Reference
EN-1 NPS for Energy		
As part of the ES the applicant should provide a description of the significance of the heritage assets affected by the proposed development and the contribution of their setting to that significance. The level of detail should be proportionate to the importance of the heritage assets and no more than is sufficient to understand the potential impact of the proposal on the significance of the heritage asset.	Paragraph 5.8.8	The significance of the archaeological receptors considered in this chapter, and the contribution of setting to that significance, have been detailed in sections 17.5.1.2, 17.5.2.2 and 17.5.3.2. Issues relating to the setting of onshore heritage assets have been considered as part of **Chapter 22 Onshore Archaeological and Cultural Heritage**.
Where a development site includes, or the available evidence suggests it has the potential to include, heritage assets with an archaeological interest, the applicant should carry out appropriate desk-based assessment and, where such desk-based research is insufficient to properly assess the interest, a field evaluation. Where proposed development will affect the setting of a heritage asset, representative visualisations may be necessary to explain the impact.	Paragraph 5.8.9	Section 17.5 of this chapter provides the results of the desk-based assessment undertaken for Offshore Archaeology and Cultural Heritage. The archaeological assessment of marine geophysical and geotechnical data (field evaluation) is underway and a full assessment of the baseline environment will be presented in the ES.
The applicant should ensure that the extent of the impact of the proposed development on the significance of any heritage assets affected can be adequately understood from the application and supporting documents.	Paragraph 5.8.10	This chapter provides a preliminary account of the potential impacts of the Projects upon heritage assets and their significance based upon desk-based assessment only (section 17.6). The results of the archaeological assessment of marine geophysical and geotechnical data will allow for the full extent of impacts to be understood and will be presented

NPS Requirement	NPS Reference	PEIR Section Reference
		in the ES which will accompany the application.
EN-3 NPS for Renewable Energy Infrastructure		
Consultation with the relevant statutory consultees (including English Heritage (sic) or Cadw) should be undertaken by the applicants at an early stage of the development.	Paragraph 2.6.140	Consultation has been undertaken with relevant statutory consultees, as outlined in section 17.2. Consultation will be on going throughout the development process.
Assessment should be undertaken as set out in section 5.8 of EN-1. Desk based studies should take into account geotechnical or geophysical surveys that have been undertaken to aid the wind farm design.	Paragraph 2.6.141	Section 17.5 of this document provides the results of the desk-based assessment undertaken for Offshore Archaeology and Cultural Heritage. The archaeological assessment of marine geophysical and geotechnical data (field evaluation) is underway and a full assessment of the baseline environment will be presented in the ES.
The assessment should also include the identification of any beneficial effects on the historic marine environment, for example through improved access or the contribution to new knowledge that arises from investigation.	Paragraph 2.6.142	Any beneficial effects to the Offshore Archaeology and Cultural Heritage resource resulting from the Projects have been identified in section 17.6.
Where elements of an application (whether offshore or onshore) interact with features of historic maritime significance that are located onshore, the effects should be assessed in accordance with the policy at section 5.8 of EN-1.	Paragraph 2.6.143	Potential impacts of the Projects upon onshore heritage assets have been considered in **Chapter 22 Onshore Archaeology and Cultural Heritage**.

NPS Requirement	NPS Reference	PEIR Section Reference
EN-5 NPS for Electricity Networks Infrastructure		
…developers will be influenced by Schedule 9 to the Electricity Act 1989, which places a duty on all transmission and distribution licence holders, in formulating proposals for new electricity networks infrastructure, to "have regard to the desirability… of protecting sites, buildings and objects of architectural, historic or archaeological interest; and … do what [they] reasonably can to mitigate any effect which the proposals would have on the… sites, buildings or objects.	Paragraph 2.2.6	Potential impacts upon sites and objects of archaeological interest offshore are set out in section 17.6 along with a proposed approach to mitigation.
Draft Overarching NPS for Energy (EN-1) (BEIS, 2021a)		
The applicant is encouraged, where opportunities exist, to prepare proposals which can make a positive contribution to the historic environment, and to consider how their scheme takes account of the significance of heritage assets affected. This can include, where possible: • Enhancing, through a range of measures such as sensitive design, the significance of heritage assets or setting affected • Considering measures that address those heritage assets which are at risk or which may become at risk, as a result of the Scheme	Paragraph 5.9.14	The potential for enhancement of the archaeological record for the North Sea is discussed in section 17.6.

NPS Requirement	NPS Reference	PEIR Section Reference
• Considering how visual or noise impacts can affect heritage assets, and whether there may be opportunities to enhance access to, or interpretation, understanding and appreciation of, the heritage assets affected by the scheme		
Draft NPS for Renewable Energy Infrastructure (EN-3) (BEIS, 2021b)		
Consultation with the relevant statutory consultees on the potential impacts on the marine historic environment should be undertaken by applicants at an early stage of development, taking into account any applicable guidance (e.g., offshore renewables protocol for archaeological discoveries).	Paragraph 2.32.4	Consultation has been undertaken with relevant statutory consultees, as outlined in section 17.2. Consultation will be on going throughout the development process. The guidance taken into account for the assessment of Offshore Archaeology and Cultural Heritage is listed in section 17.4.1.2.
Assessment of potential impacts upon the historic environment should be considered as part of the Environmental Impact Assessment process undertaken to inform any application for consent. Desk based studies to characterise the features of the historic environment that may be affected by a proposed development and assess any likely significant effects should be undertaken by competent archaeological experts. These studies should take into account any geotechnical or geophysical surveys that have been undertaken to aid the wind farm design.	Paragraph 2.32.5	Section 17.5 of this document provides the results of the desk-based assessment undertaken for Offshore Archaeology and Cultural Heritage. The archaeological assessment of marine geophysical and geotechnical data (field evaluation) is underway and the results will be presented in the ES.

17.4.1.2 Other

32. In addition to the NPS, there a number of pieces of legislation, policy and guidance applicable to the assessment of Offshore Archaeology and Cultural Heritage. These include:

- Legislation:
  - UNESCO Convention on the Protection of Underwater Cultural Heritage;
  - European Convention on the Protection of the Archaeological Heritage (Revised) 1992 (The Valletta Convention);
  - Protection of Wrecks Act 1973: Section One and Two;
  - Ancient Monuments and Archaeological Areas Act 1979;
  - Protection of Military Remains Act 1986; and
  - Merchant Shipping Act 1995.
- Policy:
  - National Planning Policy Framework (NPPF);
  - UK Marine Policy Statement; and
  - East Inshore and East Offshore Marine Plans and the North East Inshore and Offshore Marine Plan.

- Guidance:
  - Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021);
  - Principles of Cultural Heritage Impact Assessment in the UK (Institute of Environmental Management and Assessment (IEMA), Institute of Historic Building Conservation (IHBC) and Chartered Institute of Archaeologists (CIfA), 2021);
  - The Setting of Heritage Assets: Historic Environment Good Practice Advice in Planning Note 3 (Second Edition) (Historic England, 2017);
  - CIfA Standard and Guidance for Historic Environment Desk-Based Assessments (2020) and Code of Conduct (2022);
  - Marine Geophysical Data Acquisition, Processing and Interpretation – guidance notes (Historic England, 2013);
  - Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2011);
  - Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology, 2008);
  - Historic Environment Guidance for the Offshore Renewable Energy Sector Guidance (Wessex Archaeology, 2007); and
  - Code for Practice for Seabed Development (Joint Nautical Archaeology Policy Committee (JNAPC), 2006).

33. Further detail is provided in **Chapter 3 Policy and Legislative Context**.

34. Additional detail on how this legislation, policy and guidance applied to the assessment of Offshore Archaeology and Cultural Heritage is discussed, where relevant, in sections 17.5 to 17.6 below.

17.4.2 Data and Information Sources

17.4.2.1 Site Specific Surveys

35. In order to provide site specific and up to date information on which to base the impact assessment, marine geophysical and geotechnical data have been acquired from the Offshore Development Area by Fugro in 2022. Assessment of this data by specialist archaeological geophysicists at Wessex Archaeology is underway. Although the results are not yet available to inform the PEIR, the results will be communicated through the ETG meetings as part of the EPP and the full assessment results will inform the ES.

36. Further details on the survey specifications, including an assessment of the suitability of the data for archaeological assessment, will be communicated through the EPP and presented in full in the ES.

17.4.2.2 Other Available Sources

37. Other sources that have been used to inform the assessment are listed in **Table 17-5**.

Table 17-5 Other Available Data and Information Sources

Data Set	Spatial Coverage	Year	Notes
Global Wrecks and Obstructions	Global	2022	Data set containing details of charted, uncharted, live and dead wrecks and obstructions and shared on the Admiralty Marine data Portal by the United Kingdom Hydrographic Office (UKHO).
The National Heritage List for England (NHLE) maintained by Historic England	England	2022	Official, up to date, register of all nationally protected historic buildings and sites in England - listed buildings, scheduled monuments, protected wrecks, registered parks and gardens, and battlefields. (including sites protected under the Protection of Military Remains Act 1986 and the Protection of Wrecks Act 1973).

Data Set	Spatial Coverage	Year	Notes
Records held by Historic England, formally part of the National Record of the Historic Environment (NRHE) dataset	England	2022	Records of heritage assets and documented losses of wrecks and aircraft.
Humber Historic Environment Record (HER)	East Riding of Yorkshire and Hull	2022	HERs are information services that provide access to comprehensive and dynamic resources relating to the archaeology and historic built environment of a defined geographic area. HERs contain details of local archaeological sites and finds, historic buildings and historic landscapes and are regularly updated.
The Coastal and Intertidal Zone Archaeology Network (CITiZAN)	UK	2022	CITiZAN highlights the threat of coastal erosion to a wealth of foreshore and intertidal sites. These archaeological features encompass a huge time span, many are of considerable local or national significance.
Relevant documentary sources and grey literature	UK	Various	Includes reports and survey data gathered from previous offshore wind farm projects in the wider Dogger Bank area, e.g. Dogger Bank A, B, C and Sofia.

17.4.3 Impact Assessment Methodology

38. The impact assessment methodology adopted for Offshore Archaeology and Cultural Heritage will define heritage assets, and their settings, likely to be impacted by the proposed scheme and assess the level of any resulting benefit, harm or loss to their significance. The assessment is not limited to direct (physical) impacts, but also assesses possible indirect (physical) impacts upon heritage assets which may arise as a result of changes to hydrodynamic and sedimentary processes and changes to the setting of heritage assets, whether visually, or in the form of noise, dust and vibration, spatial associations and a consideration of historic relationships between places which may impact their significance.

39. **Chapter 6 EIA Methodology** provides a summary of the general impact assessment methodology applied. The following sections describe the specific methods used to assess the likely significant effects on Offshore Archaeology and Cultural Heritage.

40. As set out in Principles of Cultural Heritage Impact Assessment in the UK (IEMA, IHBC and CIfA, 2021), Cultural Heritage Impact Assessment (CHIA) is concerned with "*understanding the consequences of change to cultural significance*". The principles of assessment are:

- A. understanding cultural heritage assets; and
- B. evaluating the consequences of change.

41. Understanding cultural heritage assets distinguishes between:

- Describing the asset (what it is and what is known about it);
- Ascribing cultural significance (a description of what is valued about it); and
- Attributing importance (a scaled measure of the degree to which the cultural significance of that asset should be protected).

42. Evaluating the consequences of change additionally distinguishes between three separate analytical stages:

- Understanding change (a factual statement of how a proposal would change a cultural heritage asset or its setting, including how it is experienced);
- Assessing impact (a scaled measure of the degree to which any change would impact on cultural significance); and
- Weighting the effect (the measure that brings together the magnitude of the impact and the cultural heritage asset's importance).

43. The three stages of 'understanding cultural heritage assets' (a description of the assets and their cultural significance, including the contribution of setting to that significance, and attributing importance) are described in section 17.5 (Existing Environment). An evaluation of the consequences of change is presented in section 17.6 (Assessment of Significance) as set out below.

44. **Chapter 6 EIA Methodology** sets out the following steps in assessing significant effects:

- Identifying the source of potential impacts and establishing if a pathway exists between the source of the impact and the identified receptors;
- Identifying the sensitivity of each receptor to the relevant impacts;
- Identifying the magnitude of the impact predicted; and
- Considering the receptor sensitivity and likely impact magnitude, in order to assess the likely significance of effect for the potential impact.

45. The relationship between the CHIA stages and the general impact assessment methodology, as set out in **Chapter 6 EIA Methodology**, is as follows:

46. In CHIA, *identifying the source of potential impacts* is represented by a factual statement of how a proposal would change a cultural heritage asset or its setting (understanding change). It is important to note that change may or may not lead to an impact on cultural significance. If there is a pathway for an impact on cultural significance, this will be articulated for each impact.

47. *Identify the sensitivity* of a receptor equates to the measure of importance ascribed to an asset (or group of assets).

48. The sensitivity of a receptor is a function of its capacity to accommodate change and reflects its ability to recover if it is affected. However, while impacts to a heritage asset's setting or character can be temporary, impacts which result in damage or destruction of the assets themselves, or their relationship with their wider environment and context, are permanent. Once destroyed an asset cannot recover. On this basis, it is the importance of a heritage asset (as a scaled measure of the degree to which we seek to protect and preserve the cultural significance of that asset through, for example, legislation and planning policy) rather than the sensitivity which forms the basis for assessment.

49. For the purposes of this PEIR, the criteria for determining the heritage importance of any relevant heritage assets are described in **Table 17-6**.

Table 17-6 Definition of Importance for Cultural Heritage Assets

Importance	Definition
High	Assets perceived of being of international / national importance including: • World Heritage Sites; • Scheduled Monuments; • Grade I and II* Listed Buildings or structures; • Protected wrecks; • Designated historic landscapes of outstanding interest; • Conservation Areas containing buildings or structures with high heritage importance, or high concentrations of listed buildings; • Non-designated assets of acknowledged international / national importance; and • Assets that can contribute significantly to acknowledged international / national research objectives. Assets where the importance / existence / level of survival of the asset has not been ascertained (or fully ascertained / understood) from available evidence and is therefore considered of high importance as a precautionary measure
Medium	Assets perceived of being of regional importance including: • Grade II Listed Buildings or structures; • Designated special historic landscapes; • Other types and character of Conservation Areas (i.e. not containing buildings or structures with high heritage importance, or high concentrations of listed buildings); • Assets that contribute to regional research objectives; and • Assets with regional value, educational interest or cultural appreciation.

Importance	Definition
Low	Assets perceived of being of local importance including: • 'Locally Listed' buildings or structures; • Assets that contribute to local research objectives; and • Assets with local value, educational interest or cultural appreciation. Assets compromised by poor preservation and / or poor contextual associations
Negligible	Assets with no significant value or archaeological / historical interest.

50. *Identify the magnitude* of the impact equates to the degree to which cultural significance is positively or negatively changed by the proposal.

51. The magnitude of adverse impact with respect to Offshore Archaeology and Cultural Heritage directly relates to the extent of harm to, or loss of, key elements of the assets cultural significance, which may include its setting. The magnitude of beneficial impact directly relates to the level of public benefit associated with an individual impact. Benefits may correspond directly to the project itself where a project will enhance the historic environment (e.g. through measures which will improve the setting of a heritage asset or public access to it). Alternatively, benefits may occur on the basis of data gathering exercises undertaken for the purpose of a project which will enhance public understanding by adding to the archaeological record (e.g. through the accumulation of publicly available information and data).

52. The criteria used for assessing the magnitude of impact with regard to Offshore Archaeology and Cultural Heritage are presented in **Table 17-7**.

Table 17-7 Definition of Magnitude of Impacts

Magnitude	Definition
High Adverse	Key elements of the asset's fabric and / or setting are lost or fundamentally altered, such that the asset's cultural significance is lost or severely compromised.
Medium Adverse	Elements of the asset's fabric and / or setting which contribute to its significance are affected, but to a more limited extent, resulting in an appreciable, but partial, loss of the asset's cultural significance.
Low Adverse	Elements of the asset's fabric and / or setting which contribute to its cultural significance are affected, resulting in a slight loss of cultural significance.
Negligible	The asset's fabric and / or setting is changed in ways which do not materially affect its cultural significance.
Low Beneficial	Elements of the asset's physical fabric which would otherwise be lost, leading to a slight loss of cultural significance, are preserved in situ; or Elements of the asset's setting are improved, slightly enhancing its cultural significance; or Research and recording leads to a slight enhancement to the archaeological or historical interest of the asset. This only applies in situations where the asset would not be otherwise harmed i.e. it is not recording in advance of loss.
Medium Beneficial	Elements of the asset's physical fabric which would otherwise be lost, leading to an appreciable but partial loss of cultural significance, are preserved in situ; or Elements of the asset's setting are considerably improved, appreciably enhancing its cultural significance; or Research and recording leads to a considerable enhancement to the archaeological or historical interest of the asset. This only applies in situations where the asset would not be otherwise harmed i.e. it is not recording in advance of loss.

Magnitude	Definition
High Beneficial	Elements of the asset's physical fabric which would otherwise be lost, severely compromising its cultural significance, are preserved in situ; or Elements of the asset's setting, which were previously lost or unintelligible, are restored, greatly enhancing its cultural significance.
No impact	No change to the assets fabric or setting which affects its cultural significance.

53. The *likely significant effect* is the measure that brings together the magnitude of the impact and the cultural heritage asset's importance to assess the degree to which any change would impact on cultural significance. This measure is indicative of the weight that should be given to the matter in influencing the design of the proposal or, ultimately, in influencing whether the proposal will be acceptable and permitted.

54. The determination of significance is guided by the use of an impact significance matrix presented in **Chapter 6 EIA Methodology**. Definitions for this weighted measure of significance of effect (in EIA terms) are provided in **Table 17-8**. For the purposes of this assessment, any effect that is of major or moderate significance is considered to be significant in EIA terms, whether this be adverse or beneficial. Any effect that has a significance of minor or negligible is not significant.

Table 17-8 Definition of Effect Significance

Significance	Definition
Major	Changes in cultural significance, both adverse or beneficial, which are likely to be important considerations at a national or regional level because they contribute to achieving national or regional objectives. Effective / acceptable mitigation options may still be possible, to offset and / or reduce residual impacts to satisfactory levels.
Moderate	Changes in cultural significance, both adverse or beneficial, which are likely to be important considerations at a local level. Effective / acceptable mitigation options may still be possible, to offset and / or reduce residual impacts to satisfactory levels.
Minor	Changes in cultural significance, both adverse or beneficial, which may be raised as local issues but are unlikely to be material considerations in the decision-making process. Industry standard mitigation measures may still apply.
Negligible	No material change to cultural significance.
No change	No impact, therefore, no change to cultural significance.

17.4.4 Historic Seascape Character Assessment Methodology

55. The approach to the assessment of historic seascape character differs to that outlined above for heritage assets.

56. The historic character of the seascape is described in terms of ability to accommodate change. A key aspect of this ability is how that character is perceived by the public. For this reason, an approach is required which recognises the dynamic nature of seascape and how all aspects of the seascape, no matter how modern or fragmentary, can form part of the character of that seascape.

57. It is not meaningful, therefore, to assign a level of importance to these perceptions of character, which are by nature subjective, nor to assign a measure of magnitude in order to understand the nature of the potential changes. Rather, this change is expressed as a narrative description of the seascape character, how it is perceived by the public and how these perceptions could be affected by the Projects, which may or may not be perceived as important from a historic perspective. In this respect, while damage to, or destruction of, a heritage asset is considered permanent and irreversible, impacts to historic seascape character are dynamic, and may be temporary and reversible.

58. Changes to the historic seascape character and the extent to which these changes can be accommodated are discussed in section 17.5.4.

17.4.5 Cumulative Effect Assessment Methodology

59. The cumulative effect assessment (CEA) considers other plans, projects and activities that may result in cumulation with the Projects. **Chapter 6 EIA Methodology** provides further details of the general framework and approach to the CEA.

60. The final assessment of cumulative effects will be undertaken during the later stages of the EIA, once further information is available on a number of projects such as the Outer Dowsing Offshore Wind Farm, Hornsea Project Four decision and the Sheringham Shoal and Dudgeon Extension Projects examination. However, for the purposes of the PEIR, it is possible to identify a number of projects and plans which are likely to feature in that assessment and consider the extent to which cumulative effects might arise.

61. Section 17.8 presents the following preliminary information regarding cumulative effects:

- Screening for cumulative effects; and
- A preliminary short list of plans and projects considered for CEA, including a brief description as to how projects have been screened in and the initial tier level they have been assigned.

17.4.6 Transboundary Effect Assessment Methodology

62. The transboundary assessment considers the potential for transboundary effects to occur on Offshore Archaeology and Cultural Heritage receptors as a result of the Projects; either those that might arise within the Exclusive Economic Zone (EEZ) of European Economic Area (EEA) states or arising on the interests of EEA states e.g. a non UK fishing vessel. **Chapter 6 EIA Methodology** provides further details of the general framework and approach to the assessment of the transboundary effects.

63. For Offshore Archaeology and Cultural Heritage, the potential for transboundary effects has been identified in relation to wrecks or aircraft of non-British nationality which could be subject to impact from development. Such wrecks may fall within the jurisdiction of another country, and may include, for example, foreign warships lost in UK waters.

64. In addition, there is potential for developments, individually and cumulatively, to affect larger-scale archaeological features such as palaeolandscapes and to affect the setting of heritage assets and historic landscapes / seascapes which may also extend across these boundaries. This may also include sensitivities in conjunction with local community groups and interests.

65. Indirect transboundary impacts, associated with changes to marine physical processes, where those changes cross an international boundary, are not expected to occur. The potential for transboundary effects were considered in the Scoping Report and it was concluded that, given that the likely marine physical processes impacts of the Projects will be restricted to near-field change, coupled with its location 40.82km from the EEZ boundary, there would be no pathway for transboundary impacts. The conclusion of the Scoping Report was accepted in the Scoping Opinion, and therefore, indirect transboundary impacts are scoped out and are not considered further in this chapter.

17.4.7 Assumptions and Limitations

66. This preliminary assessment is considered to be an interim stage in the EIA process. The results presented in the following sections are based on early design assumptions and initial assessments which will be refined and presented in the final ES to be submitted as part of the DCO application.

67. In addition, the records held by the UKHO, Historic England (National Heritage List for England (NHLE) and formerly the National Record of the Historic Environment (NRHE)), Humber Historic Environment Record and the other sources used in this assessment are not a record of all surviving cultural heritage assets, rather a record of the discovery of a wide range of archaeological and historical components of the marine historic environment. The information held within these datasets is not complete and does not preclude the subsequent discovery of further elements of the historic environment that are, at present, unknown. In particular, this relates to buried archaeological features.

17.5 Existing Environment

68. The existing environment within the offshore archaeology and cultural heritage study area is defined as the known archaeological and cultural heritage resource and the potential for previously unrecorded heritage assets and finds to be present within the Offshore Development Area with respect to:

- Seabed prehistory (i.e. archaeological remains on the seabed corresponding to the activities of prehistoric populations that may have inhabited what is now the seabed when sea levels were lower);
- Maritime archaeology (i.e. the remains of boats and ships and archaeological material associated with prehistoric and historic maritime activities);
- Aviation archaeology (i.e. the remains of crashed aircraft and archaeological material associated with historic aviation activities);
- Historic seascape character (i.e. the attributes that contribute to the formation of the historic character of the seascape); and
- Buried archaeology (including palaeoenvironmental deposits) within the intertidal zone below MHWS.

17.5.1 Seabed Prehistory

17.5.1.1 Description of Heritage Assets

69. The recent geological history of the southern North Sea is directly linked to glacial / interglacial cycles experienced by the area during the Pleistocene (2.5 million to 10,000 years ago), which resulted in large areas of the southern North Sea being periodically exposed as a terrestrial environment. These glacial cycles, and accompanying changes in sea level, are recorded as Marine Isotope Stages (MIS).

70. The potential for prehistoric sites to be present within the offshore archaeology study area, either exposed on or buried below the seabed, is primarily associated with surviving terrestrial features and deposits corresponding to times when sea levels were lower and prehistoric hominin populations may have inhabited what is now the seabed.

71. Archaeological material may also be present within secondary contexts, as isolated finds within deposits that may have been reworked by marine or glacial processes. While these deposits formed during periods when the North Sea was inhabitable, they have some potential to contain reworked archaeological material.

72. There are no known in situ prehistory sites within the offshore archaeology study area. However, late Mid- and Late-Pleistocene fauna have been recovered from the wider region by trawlers and a mammoth tusk reported from Marine Aggregate Licence Area 408 (located 50km south-west of DBS) has produced a date of approximately 44,000 years Before Present (BP) (Allen *et al.*, 2008). This indicates there is some potential for prehistoric faunal remains to be present in the offshore archaeology study area.

73. Where discoveries of archaeological and faunal material are rare, submerged palaeolandscape features and deposits provide the environmental context to understand prehistory. The Dogger Bank region has long been known to preserve prehistoric landscapes and deposits (Reid, 1913; Coles, 1998). From as early as 1883, maps showing the distribution of 'moorlog' (peat / submerged forest) across Dogger Bank were produced (see Wessex Archaeology 2014 for a review). Many decades later, the North Sea Palaeolandscapes Project (Fitch *et al.*, 2005; Gaffney *et al.*, 2007) produced a regional-scale map showing the nature and distribution of prehistoric landscapes across Dogger Bank showing a complex network of palaeochannels that flooded during post glacial sea-level rise.

74. The formation of Dogger Bank is a product of the interplay between climate change, ice dynamics and sea-level change associated with the growth and demise of the British Irish Ice Sheet and Fennoscandian Ice Sheet during the last glacial period. Recent investigations have demonstrated large-scale glaciotectonic deformation across the western parts of Dogger Bank (adjacent to DBS offshore wind farms) which has created a highly complex stratigraphic record that is not a simple "*layer cake*" (Phillips *et al.*, 2018; Emery *et al.*, 2019). Interpretation of seismic data as horizon maps showing the palaeo-topography of the glacial landscape reveal a series of elongate arcuate ridges separated by low lying basins that ponded water creating proglacial lakes or kettle holes. As the climate warmed, these waterlogged

environments would have attracted fauna and people and have high potential to preserve organic deposits or palaeoenvironmental material.

75. The baseline understanding of submerged prehistory at Dogger Bank was improved following a series of geophysical and geoarchaeological investigations undertaken in support of the Environmental Statements for the Dogger Bank Creyke Beck A & B and Teesside A & B projects, now known as Dogger Bank A, B and C and Sofia, respectively. A series of palaeolandscape features were identified including a network of palaeochannels, a possible pingo lake (depression caused by melting ice) and peat deposits (Wessex Archaeology, 2013a; 2013b). Further evidence of submerged palaeolandscapes was reported through the Offshore Protocol for Archaeological Discoveries (ORPAD) in 2012 when peat was recovered from the seabed during a benthic ecological survey (Russell and Stevens, 2014). Palaeoenvironmental assessment of peat deposits indicated remnants of Upper Palaeolithic to Mesolithic landscapes were preserved.

76. A series of ongoing geoarchaeological and marine geophysical assessments are being undertaken for the consented Dogger Bank A (DBA), Dogger Bank B (DBB), Dogger Bank C (DBC) and Sofia offshore wind farms. These are providing high resolution maps of the extensive prehistoric landscape (Wessex Archaeology, 2020a) and palaeoenvironmental assessment and dating of deposits from wetland, riverine, lake and coastal environments is ongoing (Wessex Archaeology, 2022).

77. A geotechnical survey undertaken within the DBS array areas in 2022 acquired five boreholes to depths of 55m. The borehole logs were reviewed by a geoarchaeologist to gain an initial understanding of the nature of the shallow geology of the offshore archaeology study area (**Table 17-9**). The results suggest the shallow stratigraphy is broadly the same as in the adjacent DBA and DBB sites (Wessex Archaeology, 2022). However, this is subject to change pending further geotechnical surveys.

Table 17-9 Shallow Geology of the Offshore Archaeology Study Area

Unit Name	Lithology	Epoch	BGS Formation	Archaeological potential
Gravel Lag	Sandy gravel with shell	Early to mid-Holocene	Indefatigable Grounds	Considered of low potential in itself, but possibly contains re-worked artefacts and can cover wreck sites and other cultural heritage.
Shallow Marine Sand	Slightly gravelly sand with shell fragments	Middle to Late-Holocene	Nieuw Zeeland Gronden Terschellinger Bank or Well Hole	
Alluvium	Slightly gravelly sand with rare organic matter, organic laminations and shell fragments	Early Holocene	Elbow	Potential to contain in situ and derived archaeological material, and palaeoenvironmental material.
Alluvium and Peat	Low to medium strength clay with fibrous wood fragments and rare organic matter	Early Holocene	Elbow	
Proglacial	Not recorded	Late Weichselian	Botney Cut	Glaciomarine deposits considered to have low potential. Glaciolacustrine deposits have potential to contain in situ and derived archaeological material, and palaeoenvironmental material.
Diamict and Glacial Sand	Stiff high strength gravelly clay with occasional beds of clayey sand	Weichselian	Bolders Bank or Dogger Bank	Considered low but has potential to bury deposits of interest or to contain re-worked material.
Pre-Glacial Sand	Fine sand with rare lamina of	Holstenian to Eemian	Egmond Ground, Cleaver Bank,	Potential to contain in situ and derived

Unit Name	Lithology	Epoch	BGS Formation	Archaeological potential
	clay or organic matter, fragments of organic matter, wood and shell		Tea Kettle Hole or Eem	archaeological material, and palaeoenvironmental material.

78. Of the six units anticipated to be present within DBS, five were recorded in the boreholes.

79. Deposits of archaeological interest include Alluvium and Peat which have potential to contain in situ and derived archaeological material, and palaeoenvironmental material. The geoarchaeological review of DBS boreholes identified a sequence of silt and clay (alluvium) interbedded with a thin (0.28m) peat deposit at a depth of 18m below seafloor in borehole BBSW-005-BH-A. Core sample photographs suggest a large (up to 10cm) piece of wood is preserved within the peat and a sample has been retained for future palaeoenvironmental assessment. These deposits indicate there is high potential for remnants of prehistoric landscapes to be present in DBS, although these may be buried below significant thicknesses (>10m) of recent Shallow Marine Sand.

80. Proglacial deposits were not recorded, but this may reflect low data resolution and there is potential for these deposits to be present in DBS. The archaeological potential of Proglacial deposits depends on their depositional history and relative sea-level history. If laid down in warming periglacial landscape, these deposits have the potential to preserve palaeoenvironmental records and as such, understanding their formation history is of geoarchaeological interest.

81. The lowermost deposits across the Dogger Bank are characterised by sand-rich formations representing deposition in marine, terrestrial, periglacial and intertidal environments (Egmond Ground Formation, Cleaver Bank Formation, Tea Kettle Hole Formation and Eem Formation). Of these, Cleaver Bank Formation and Tea Kettle Hole Formation are of archaeological interest as they were deposited during the Saalian period (MIS 6) when sea levels were lower, and the southern North Sea was sub-aerially exposed. These formations represent deposition in a periglacial or aeolian environment during the Middle Palaeolithic, a period of known hominin occupation in Britain and the southern North Sea (e.g. Bicket and

Tizzard, 2015). Understanding the formation history of the Pre-Glacial Sand unit is, therefore, important for defining archaeological potential.

82. Three units have low archaeological potential. Shallow Marine Sand and Gravel Lag are the youngest deposits and reflect deposition in a marine environment during and after rising sea levels flooded Dogger Bank in the early to middle Holocene. These deposits have the potential to contain reworked archaeological material, or to bury other cultural heritage such as wrecks. The Diamict and Glacial Sand unit represents processes occurring at or below an ice sheet during the last glacial period when the Dogger Bank was unsuitable for hominin occupation and as such, these deposits have low archaeological potential, although they may bury or seal older deposits of interest.

83. The 2022 boreholes are located within the proposed DBS array areas and do not extend into the proposed offshore export cable corridor. However, archaeological investigations for the DBA cable corridor can be used to gain an understanding of the prehistoric landscape potential (Wessex Archaeology, 2020b; 2022), given the juxtaposition of the DBA cable corridor to the DBS cable corridor along much of its route. Fine-grained deposits interpreted as possible alluvium are present locally within the DBA export cable corridor. Geoarchaeological recording of these deposits indicate they were laid down in an intertidal / estuarine environment, most likely during the Early Holocene sea-level rise. Elsewhere along the DBA export cable route, glacial deposits and recent shallow marine sand dominate the shallow geology.

84. Considering the location of DBS at the western margin edge of the Dogger Bank, which is known to preserve palaeolandscape features and deposits of archaeological interest, and the recovery of organic and palaeoenvironmental material in a borehole located in DBS, there is high potential for submerged prehistoric landscape features and deposits to be present. This potential will be assessed using project-specific geophysical and geotechnical data and incorporated into the ES.

17.5.1.2 Cultural Significance of Heritage Assets

85. There are no known seabed prehistory sites within the offshore archaeology study area for which significance can be described. As such, the significance of these palaeolandscapes lies primarily in their archaeological interest or research value, particularly when considered alongside survey data and interpretations produced for other seabed development projects on the Dogger Bank.

86. The setting of a heritage asset is described as the surroundings in which a heritage asset is experienced (Historic England, 2017). Elements of a setting may make a positive or negative contribution to the cultural significance of an asset, may affect the ability to appreciate that cultural significance or may be neutral. Historic England's guidance on setting notes how the setting of buried heritage assets may not be readily appreciated by a casual observer but retain a presence in the landscape.

87. For offshore assets, for the most part, submerged archaeological sites are not 'readily appreciated by a casual observer'. With respect to former prehistoric landscapes in the southern North Sea, these are largely experienced conceptually in terms of interpreted data and research. As such, the setting of these assets (in terms of the surroundings in which they are experienced) does not form a key part of their cultural significance. However, changes within the physical setting will occur (i.e., the introduction of the Projects into the seascape) and the capacity of these palaeolandscapes to accommodate this change is discussed alongside historic seascape character in section 17.5.4.

17.5.1.3 Importance of Heritage Assets

88. The rarity of in situ prehistoric sites in the offshore contexts means that, should such sites be encountered, these will be of national, or possibly international interest, with significant potential to contribute to acknowledged international and national research objectives. Given the particularly high importance of these in situ sites, the features and deposits which have the potential to contain in situ prehistoric archaeological material (i.e. interpreted palaeo-land surfaces and palaeolandscape features) should also be considered of high importance. Similarly, should palaeoenvironmental evidence be discovered in the context of an in situ prehistoric site this would also be of high importance.

89. Although palaeoenvironmental material encountered beyond the context of an in situ prehistoric site still has evidential value for understanding changes in the climate and environment with offshore contexts, isolated discoveries should be considered of low importance for the purposes of assessment.

90. Isolated finds of prehistoric archaeological material within secondary contexts, comprising material from terrestrial phases that may have been reworked by marine or glacial processes, also have evidential value for understanding patterns of population and exploitation of landscapes, for example. However, as these finds are derived, and out of context, they are regarded as being of medium rather than high importance.

91. The heritage importance of the potential heritage assets outlined above are presented in **Table 17-10**.

Table 17-10 Heritage Importance (Seabed Prehistory)

Asset Type	Definition	Importance
Potential in situ prehistoric sites	Primary context features and associated artefacts and their physical setting (if/where present)	High
	Known submerged prehistoric sites and landscape features with the demonstrable potential to include artefactual material	High
Potential submerged landscape features	Other known submerged palaeolandscape features and deposits likely to date to periods of prehistoric archaeological interest with the potential to contain in situ material	High
Potential derived prehistoric finds	Isolated discoveries of prehistoric archaeological material discovered within secondary contexts	Medium
Potential palaeoenvironmental evidence	Isolated examples of palaeoenvironmental material	Low
	Palaeoenvironmental material associated with specific palaeolandscape features or archaeological material	High

17.5.2 Maritime and Aviation Archaeology

17.5.2.1 Description of Heritage Assets

92. As stated in section 17.4.2.1 site specific geophysical data have been acquired and are currently being assessed by Wessex Archaeology. The results will be communicated through the ETG meetings as part of the EPP and the full assessment results will inform the ES.

93. The existing environment for this PEIR chapter is, therefore, based on a desk-based review of existing records of wrecks and seabed features which may be of archaeological interest based on the sources set out in **Table 17-5**.

94. There are no designated wrecks or other types of protected sites within the offshore archaeology study area. There is, however, one record from the UKHO which describes the recovery of material from a crashed Tornado (UKHO ID 6586). Should any material from a crashed military aircraft be encountered located within the offshore archaeology study area, these would automatically be protected under the Protection of Military Remains Act 1986.

95. There are 78 records of previously recorded wrecks and obstructions within the offshore archaeology study area. Full details of these records are provided in the gazetteer in **Appendix 17-1.** The locations are shown on **Figure 17-1** with a summary provided in **Table 17-11** and described below. A 'live' wreck is a wreck considered to exist by the UKHO. A 'dead' wreck is a wreck which has not been detected by repeated surveys and is considered not to exist by the UKHO. However, as remains may still be present, possibly buried, at the recorded location of a 'dead' wreck these records are retained as part of the archaeological baseline.

Table 17-11 Summary of Records of Wrecks and Obstructions by Area

Category	DBS East	DBS West	Offshore Export Cable Corridor	Total
Wreck	3	5	6	14
Wreck (modern)	3	0	2	5
Wreck (dead)	3	3	3	9
Wreck Recorded on Fisheries Chart (not surveyed)	2	16	0	18
Debris/Find	2	1	0	3
Feature (natural/ modern)	9	1	2	13
Obstruction Reported by Fisher-men	0	0	11	11
Reported Loss	0	0	5	5
			Total	78

96. Fourteen of the records correspond to previously recorded wrecks which are considered 'live' and likely to comprise physical remains of archaeological interest, or possible archaeological interest (**Table 17-12**).

Table 17-12 Summary of Previously Recorded 'Live' Wrecks

Project Area	UKHO ID	Summary Description
DBS East	6896	Wreck shown on Danish Fisheries Chart 5400 (1965 edition) located during survey in 1990.
	6900	Wreck shown on Danish Fisheries Chart 5400 (1965 edition) located by divers in 1990 and described as an old merchant vessel, well dispersed with much lead pipe scattered on the seabed.
	97864	Wreck, newly identified in 2021 and described as intact with dimensions 33.26 x 7.4m.
DBS West	6790	Wreck originally recorded in 1968 and 1971, and also shown on Danish Fisheries Chart 5400 (1965 edition). Last recorded in 1986 as probably mostly covered with sand, except for the mast.
	6824	Wreck shown on Danish Fisheries Chart 5400 (1965 edition) recorded as a definite wreck in 1982.
	6837	Recorded as a definite wreck in 1982.
	6808	Wreck recorded in 1960, shown on Danish Fisheries Chart 5400 (1965 edition) and located during survey in 1977.
	97582	Wreck recorded in 2021 as decaying and broken-up with dimensions 63.7 x 9.4m.
Offshore Export Cable Corridor	6596	Wreck found in 2008 during a search by the Ocean Technology Foundation for the *Bonhomme Richard* and recorded as a steel hulled vessel, 31 x 6.5m, possibly in three parts.
	6617	Wreck originally recorded between two sandwaves in 1987 with dimensions 35 x 9m although only rocks were observed at this position during a search by the Ocean Technology Foundation for the *Bonhomme Richard* in 2008.
	6698	Wreck of a fishing vessel found in 2008 during a search by the Ocean Technology Foundation for the *Bonhomme Richard* and is recorded lying intact and upright on the seabed, with masts visible and dimensions 50 x 25m.
	6849	Wreck seen in 1986 in a trough between two sandwaves with a height on 1.9m and length 25m.
	97497	Wreck recorded in 2021 as heavily degraded with part of the bow and a boiler visible 11.9 x 3.3m.

Project Area	UKHO ID	Summary Description
	6470	*Feltre*, originally the *Rhenania*, a steamship built in Germany in 1904 as a passenger ship for the Hamburg-Amerika Line. At the outbreak of WWI the ship was requisitioned and re-named Feltre by the Italian government and put to use as a cargo ship. Feltre was on route to the Tyne with a cargo of iron ore when the vessel was torpedoed and sunk by the German submarine UB-32 on 26th August 1917. The wreck was positively identified in 1986, from the original name on the ships bell found by divers. The site is known locally as Cap Morel, or Cattermole. The wreck was last recorded in2016 with dimensions of 135.4 x 34.2 x 11.3m, broken up with a strong magnetic anomaly.

97. Five of the records related to modern losses of vessels which were the:

- *Annemarie Palm 2* (UKHO ID 97394 and 6772) lost in 1977 (fishing vessel);
- *Storm Drift* (UKHO ID 6485) lost in 1980 (fishing vessel);
- *Our Lorraine* (UKHO ID: 6486) lost in 1975 (fishing vessel); and
- *Emmalies Funk* (UKHO ID: 6782) lost in 1973 (German cargo ship).

98. As 'modern' vessels lost post-1970 these wrecks are not of archaeological significance. *Emmalies Funk* (UKHO ID: 6782) is considered a 'dead' wreck by the UKHO and appears to present a recorded location of loss only, remains of the vessels itself having not been found.

99. Nine further records are 'dead' wrecks i.e. a wreck not found by repeated survey and considered not to exist at the recorded position. Eight are unidentified (UKHO IDs 6773, 6775, 6780, 6793, 6796, 6811,6838 and 6870) and have descriptions which suggest physical remains may not be present at the recorded positions. The ninth is the wreck *Resercho* (UKHO ID 6586) a British vessel lost in 1939 after hitting a mine. The position was originally recorded as an obstruction by fishermen but, in 1986, large pieces of wreck were located by the fishing vessel *Alatna* during a search for aircraft wreckage, believed to be from a crashed Tornado. Nothing was found at this location in 2016 and the record was amended to 'dead'.

100. Three records correspond to possible debris or finds on the seabed:

- UKHO ID 99482: possible anchor or fishing gear with dimensions 6.3 x 2m.
- UKHO ID 99468: possible debris or foul ground with dimensions 11.4 x 1.1m.
- UKHO ID 66667: wrought iron bars reported in 2005, probably part of a ship's cargo lost prior to the construction of the Forbes platform and facilities.

101. One record represents a modern pipeline (UKHO ID 59370) and 12 further records are probable natural features rather than wreck remains, based upon the provided descriptions (UKHO IDs 6791, 6783, 6871, 99469, 99471, 99472, 99474, 99475, 99476, 99477, 99478 and 99481).

102. There are 11 records which note the positions of obstructions reported by fisherman, six of which are considered 'dead' by the UKHO (UKHO IDs 6475, 6585, 6643, 6644, 6649, 6684) and five of which are recorded in the former NRHE dataset only (NRHE ID 1003416, 1003463, 1003381, 1003428, 1003429). These recorded obstructions could indicate the presence of wreckage or a submerged feature although no such remains have been confirmed to date. Similarly, 18 records correspond to wrecks shown on Danish Fisheries Chart 5400 (1965 edition) which have not subsequently been surveyed by the UKHO. The presence or absence of physical remains at these locations cannot be determined from the provided descriptions and further assessment will be required to clarify the potential presence of archaeological remains.

103. The remaining five records correspond to UKHO records which document reported locations of loss rather than actual wreck remains. These are discussed further below in terms of further potential for previously unrecorded maritime and aviation remains.

104. All of the recorded positions within the offshore archaeology study area will be reviewed as part of the archaeological assessment of site specific survey data being undertaken by Wessex Archaeology with the results presented in the ES.

105. In addition to the 'wrecks and obstructions' summarised above there is potential for the presence of previously unrecorded maritime archaeological material to be present, dating from the Mesolithic period up to the present day. Similarly, there is potential for the discovery of previously unknown aircraft material.

106. The maritime records maintained by Historic England (and part of the former NRHE) group recorded losses at arbitrary points on the seabed called Named Locations, these represent general loss locations and do not (unless by chance) relate to actual seabed remains. As stated above, the UKHO dataset also includes five recorded loss locations which do not correspond to actual remains.

107. There are two named locations within 5km of the offshore archaeology study area (**Figure 17-1**): 'Hornsea Humberside' at NGR TA2094048320 and 'Filey Bay North Yorkshire' at NGR TA4675080610. The are 26 reported losses grouped at Hornsea and only one at the off 'Filey Bay' location.

108. Twenty-four of the records correspond to 19th century losses of fishing or cargo vessels . Only one record relates to an earlier loss, corresponding to the 1327 wreck of a Flemish cargo vessel which stranded, laden with herrings, at Hornsea after being driven ashore "*by the tempest*" (NRHE ID 1450776).

109. The remaining three records correspond to WWII military aircraft losses, all British aircraft lost in 1940 (NRHE ID 1321326, Whitley MK V P5002), 1943 (NRHE ID 1352689, Bristol Beaufighter MK VI T5316) and 1944 (NRHE ID 1340795 Lancaster MK I ME747).

110. Two of the UKHO losses are recent losses in 1971 (UKHO ID 8559, the cargo vessel *Welfare*) and 1990 (UKHO ID 6400, fishing vessel *Mateley B*). The vessel *Rubico* (UKHO ID 6517) was lost in 1904 following a collision, but has not been found, and the wrecks *Nitedal* (UKHO ID 5804/ NRHE ID 978621) and *Leka* (UKHO ID 57495/ NRHE ID 1454594) were both lost after being torpedoed by a German submarine in 1917. The NRHE record confirms that the wreck of the *Nitedal* has since been confirmed at another location outside the offshore archaeology study area. The UKHO description for *Leka* describes how the site had been suggested to be the remains of either the *Nitedal*, *Leka* or both although the site was no longer considered to be danger to navigation in 1918 and nothing was found at this location in 1931 or 1980.

111. Further details of these losses are provided in **Appendix 17-1**.

112. The potential for further maritime and aviation archaeological material will be further clarified following the assessment of marine geophysical data by Wessex Archaeology with the results included in the ES.

17.5.2.2 Cultural Significance of Heritage Assets

113. The cultural significance of unidentified wrecks and debris and potential wrecks, aircraft and isolated finds (which are yet to be discovered) is currently unknown. The archaeological interest (or otherwise) of features located within the construction footprint, and which may be impacted by the Projects, will be further examined post-consent (e.g. investigation of individual anomalies (ground-truthing) through Remotely Operated Vehicles (ROV) and / or diver survey). Once the character, nature and extent of selected features are more fully understood, their cultural significance can be described to inform any requirements for further work on a case by case basis.

114. The cultural significance of shipwrecks lies largely in their historic and archaeological interest, in terms of their historical associations with people or events and with their research value.

115. There is currently only one identified wreck of archaeological interest known to exist with the offshore archaeology study area, the *Feltre* (UKHO ID 6470 / NRHE ID 907939). Previously named *Rhenania*, this steam ship was built in Germany in 1904, with a quadruple expansion engine of 387hp and screw propulsion, by Bremer Vulkan in Vegesack. The vessel was designed for the Hamburg-Amerika Line to carry over 260 passengers. The dimensions of the vessel are recorded as 124.7m (length) x 16.2m (width) x 8.5m (draught) with a tonnage of 6455. The ship had two decks, a poop deck of 255 feet and forecastle of 46 feet.

116. At the outbreak of WW1 the *Rhenania* was laid up in Naples and was requisitioned and renamed *Feltre* by the Italian Government and put to use as a cargo ship. Feltre was on route to the Tyne with a cargo of iron ore when the vessel was torpedoed and sunk by the German submarine UB-32 on 26th August 1917.

117. The loss of this vessel during WWI in 1917 after being torpedoed is of particular cultural significance. It is noted that two further cargo vessels, *Nitedal* (UKHO ID 5804 / NRHE ID 978621) and *Leka* (UKHO ID 57495 / NRHE ID 1454594), are reported to have been torpedoed in 1917, although the remains are not known to be present within the offshore archaeology study area itself.

118. The study East Coast War Channels in the First and Second World War (Firth, 2014) examines the spatial extent of navigation channels and minefields between the Thames and the Scottish border during both wars and the heritage assets that are associated with these channels. Together with the presence of military installations at the landfall (see section 17.5.3) the context of the East Coast war channels represents the wider setting of 20th century military activity within which the offshore archaeology study area is located. The use and loss of the wrecks against the wider backdrop of hostile military action along the east coast means that their setting should be considered to contribute to their significance, although this corresponds more broadly to their cumulative research value.

119. Similarly, although there are no known aircraft crash sites within the offshore archaeology study area (with the exception of a possible modern Tornado crash site) the aircraft losses reported during WWII further demonstrate this military setting.

120. However, it is also notable that the largest number of reported losses represent 19th century losses of fishing and cargo vessels of local, vernacular types (e.g. brigs, snows, dandys, luggers and schooners) rather than larger sailing ships and steamships. This is indicative of the importance of coastal trade and fishing to the region and should any of these vessels be identified these would likely have particular local / regional cultural significance.

17.5.2.3 Importance of Heritage Assets

121. The importance of unidentified wrecks and debris, and potential wrecks, aircraft and isolated finds (which are yet to be discovered) is currently unknown and these are, therefore, assessed as being of high importance as a precautionary measure. However, for 'potential' sites each individual discovery will be considered independently and any requirements for further data gathering or analysis will be considered on a case-by-case basis proportionate to the importance of the discovery.

122. As a broken up wreck, the *Feltre* is not considered to represent an example which could be considered of national importance warranting protection at a national level. On the basis the wreck may be considered an asset of regional interest, due to its association with the military activities of WWI, *Feltre* is assessed as being of medium importance.

123. Isolated finds of maritime or aviation origin within secondary contexts will have evidential value for patterns of activities offshore, and are assessed as being of medium importance.

124. The heritage importance of the heritage assets outlined above are presented in **Table 17-13**.

Table 17-13 Heritage Importance (Maritime and Aviation Archaeology)

Asset type	Definition	Importance
Known maritime heritage assets	*Feltre* (UKHO ID 6470/NRHE ID 907939)	Medium
	Unidentified wrecks and associated debris	High
Potential wrecks	Wrecks within the offshore archaeology study area that are yet to be discovered	High
Potential derived maritime finds	Isolated artefacts lost from a boat or ship or moved from a wreck site	Medium
Potential aircraft	Aircraft within the offshore archaeology study area that are yet to be discovered	High
Potential derived aviation finds	Isolated artefacts lost from an aircraft or moved from a crash site	Medium

17.5.3 Intertidal Archaeology

17.5.3.1 Description of Heritage Assets

125. There are no designated heritage assets below MHWS at the landfall.

126. Records of non-designated heritage assets within the intertidal zone have been compiled from searches of the Humber HER and records held by Historic England which were formally part of the NRHE dataset. Records of heritage assets which were once located on land, but which have been lost due to coastal erosion, have also been included as relevant to the potential for fragmentary remains to survive within the offshore archaeology study area. The locations of these heritage assets are illustrated on **Figure 17-3** with a full list provided in **Appendix 17-1**.

127. The assessment of the intertidal baseline was further supported by a heritage walkover survey which took place over four days from 5 to 8 December 2022. The full results of the walkover survey are presented in **Appendix 22-3**.

128. The records suggest a high potential for archaeological remains within the intertidal zone, including buried archaeology, corresponding to three main areas of potential:

- Prehistoric and Roman archaeology including the potential for buried features and paleoenvironmental remains;
- Medieval and post-medieval sites relating to former settlements which have been lost due to coastal erosion; and
- 20th century military installations and coastal defences, many of which have also been lost or have fallen onto the beach due to coastal erosion.

17.5.3.1.1 Prehistoric and Roman

129. Earlier Prehistoric activity is demonstrated through the presence of findspots of faunal remains (Humber HER 16379, 6665, 8834, 18037), flint and bone implements (Humber HER 21182, 20667, 8835, 3413) and an unidentified amber object (Humber HER 8977). A number of undated pits, ditches and buried deposits observed in the eroding cliff face may also represent early Prehistoric features (Humber HER 21228, 21231, 21232, 21236, 21239, 18037).

130. During the heritage walkover survey an organic/peat deposit was observed in the cliff face at the northern point of the Seaside Caravan Park at the recorded location of Humber HER 18037 (a Prehistoric animal bone recovered from organic deposit at Ulrome cliffs) (see **Appendix 22-3**). Peat sequences at the Holderness Coast have been dated to the Mesolithic, c. 11.6 ka (Evans and Thompson, 2010). This deposit, therefore, likely represents a prehistoric buried deposit, although the precise date is unknown. Other features visited during the walkover survey were not observed (Humber HER 21226, 21227, 21228, 21231, 21232, 21236, 21239) and have likely been lost due to coastal erosion.

131. Finds of later Prehistoric material include a Bronze Age Beaker from the Withow Peat Bog (Humber HER 3407) and a bronze spearhead from the beach (Humber HER 4409). An 'alleged lake dwelling' of possible Neolithic to Iron Age date is reported to have been discovered in 1894, recorded near the northern end of the Skipsea lacustrine deposit, exposed in the cliffs and comprising a dense mass of twigs and brushwood on top of a pointed stake (Humber HER 8849). Similarly, a further possible 'lake dwelling' comprising carved wooden rods and stakes of early Neolithic age are reported from the carr peats exposed at Withow Mere (Humber HER 9001).

132. Iron Age and Roman findspots include coins (Humber HER 13459, 4523) and a sherd of Romano-British pottery (Humber HER 21182) found on the beach, or within the eroding cliffs. Further recorded features include an Iron Age ditch, drain, pottery and animal bone (Humber HER 15807) and a probable Roman-British pit and contemporary pottery (Humber HER 15808) found during a watching brief at Ulrome caravan park, now destroyed by erosion. A former Roman settlement site is also recorded at a location now in the intertidal zone (Humber HER 3759). The site, found in 1950 and 1952, comprised Romano-British calcite gritted ware, Samian ware, an Iron Age/Romano-British storage jar and hard grey fabrics. The site had been exposed by coastal erosion and most likely represented a small village site, now presumed destroyed by further erosion.

133. The potential for Prehistoric and Roman finds should, therefore, be considered high. Due to coastal erosion, in situ sites within the intertidal zone are unlikely to survive, although isolated finds may be encountered. Features, such as the organic deposit at Ulrome Cliffs (Humber HER 18037), however, may survive in situ exposed in the cliff face and there is potential for further buried deposits and pits or ditches to be exposed with ongoing coastal erosion.

17.5.3.1.2 Medieval and Post-medieval

134. There are a number of towns and villages know to have been lost due to coastal erosion along the Holderness Coast. Within the offshore archaeology study area the former locations of Cleeton (Humber HER 3412), Withow (Humber HER 8838) and Hyde (Humber HER 8845) are recorded, although no known archaeological remains are associated with these locations. Similarly, a 19th-century farmhouse was recorded on the cliff edge in a derelict condition in 2009, presumably now lost, (Humber HER 15032) and a group of seaside huts on the coastline at Skipsea are also recorded as demolished due to costal erosion (Humber HER 21797). No evidence of these former structures was observed during the heritage walkover (**Appendix 22-3**). A further former asset includes the site of a fish weir (Humber HER 15051) shown on the O.S. 6" first edition map from 1855.

135. There are no Medieval or Post-medieval findspots recorded from within the offshore archaeology study area, although two features previously observed in the cliff face are recorded as being of likely Medieval or Post-medieval date (Humber HER 21226, 21227).

136. These previously recorded finds and features suggest a lower potential for encountering Medieval or Post-medieval archaeological material within the intertidal zone, in comparison to Prehistoric material, for example. However, isolated finds or further features within the cliff face may also prove to date to this period.

17.5.3.1.3 20th Century Military Activity

137. The majority of the records recorded from the offshore archaeology study area correspond to WWII activity although many of these features are no longer extant. Further details are provided in **Appendix 17-1**.

138. In summary, the records primarily correspond to former coastal defence structures, many recorded from aerial photographs, including a large number of pillboxes, anti-tank obstacles, beach lights, gun emplacements, observation posts, beach scaffolding and anti-aircraft obstacles and other features including weapons pits, trackways, barbed wire obstructions and military buildings. Two records correspond to the former locations of military training camps observed on aerial photographs, both since lost due to coastal erosion (Humber HER 21192 and 21221).

139. During the heritage walkover survey a number of these previously recorded locations were visited (**Appendix 22-3**). Most were not observed to survive extant, although remains which were observed on the beach comprised:

- Pillbox 21224: observed on the beach, heavily eroded with only a small corner of the pillbox surviving;
- Pillbox 21233: largely broken up with only fragments remaining;
- Pillbox 21237: now on the beach with the remains only partially visible in the sand;
- Pillbox 21242: the Humber HER records a pillbox roof at his location however only widely distributed remains were observed, partially within the sea at low tide; and
- Beach Obstacles 21244: the Humber HER records WWII beach obstacles consisting of a concrete block with steel pipes, the beach was seen to be littered with concrete and metal debris, particularly along this stretch of the beach although this is also in proximity to the location where previous makeshift seaside huts (MHU21797) once stood on the cliff.

140. Notably, none of the previously recorded anti-tank cubes were seen to survive on the beach.

141. The potential for WWII remains should be considered high. However, due to the action of coastal erosion these will be fragmentary and most likely to comprise the remains of structures which once would have stood on the cliff top. In situ remains such as beach scaffold poles and anti-tank cubes may survive, potentially buried, although these may now be located further offshore.

17.5.3.2 Cultural Significance of Heritage Assets

142. The majority of the Humber HER records relate to previously recorded assets and findspots which are no longer present, although there is high potential for the presence of Prehistoric finds, and potentially *in situ* features in the cliff face, and for the fragmentary remains of WWII defensive structures. Their cultural significance, therefore, is currently unknown although the archaeological interest (or otherwise) of any remains which come to light during the course of the Projects will be described to inform any requirements for further work on a case by case basis.

143. Previously recorded assets and findspots are no longer present within their 'setting' and setting does not, therefore, contribute to their significance. However, whilst buried archaeological sites may not be 'readily appreciated by a casual observer' the presence of any WWII defensive structures which may be present will be encountered within their intended coastal setting, a contextual setting which was fundamental to their use in the defence of Britain during WWII. In this respect, should such remains be present, their setting would contribute to their significance. However, this contribution is limited through their survival as fragmentary, buried remains as opposed to *in situ* extant structures.

17.5.3.3 Importance of Heritage Assets

144. Should *in situ* prehistoric sites be encountered, particularly in context with nearshore evidence of prehistoric occupation, these will be of national, or possibly international interest, with significant potential to contribute to acknowledged international and national research objectives. Given the particularly high importance of these in situ sites, any palaeoenvironmental evidence discovered in the context of an *in situ* prehistoric site would also be of high importance.

145. Although palaeoenvironmental material encountered beyond the context of an *in situ* prehistoric site still has evidential value for understanding changes in the climate and environment within offshore contexts, isolated discoveries should be considered of low importance for the purposes of assessment.

146. Isolated finds of prehistoric archaeological material within secondary contexts, also have evidential value for understanding patterns of population and exploitation of former landscapes, for example. However, as these finds are derived, and out of context, they are regarded as being of medium rather than high importance.

147. The fragmentary and buried remains of WW2 coastal defences and isolated finds relating to WW2 activities are also assessed as being of medium importance.

148. The heritage importance of the potential heritage assets outlined above are presented in **Table 17-14**.

Table 17-14 Heritage Importance (Intertidal Archaeology)

Asset Type	Definition	Importance
Potential *in situ* prehistoric sites	Primary context features and associated artefacts and their physical setting (if/where present)	High
Potential palaeoenvironmental evidence	Isolated examples of palaeoenvironmental material	Low
	Palaeoenvironmental material associated with prehistoric settlements or archaeological evidence for prehistoric activities	High
Intertidal heritage assets	WW2 coastal defences (fragmentary and buried remains on beach)	Medium
Potential derived intertidal finds	Isolated artefacts and findspots dating to all periods which are located within the intertidal zone	Medium

17.5.4 Historic Seascape Character

149. The historic seascape character of coastal and marine areas around England has been mapped through a series of eight separate Historic Seascape Characterisation (HSC) projects funded by Historic England and undertaken between 2008 to 2014. This has since been followed by an initiative to consolidate the existing projects into a single national database (LUC, 2017a, 2017b, 2017c). The programme uses GIS to map data that can be queried to identify the key cultural processes that have shaped the historic seascape within a given area.

150. The consolidated national GIS dataset was mapped against the offshore archaeology study area to identify the primary cultural processes which have shaped the historic seascape of this area. This includes both the current character types (**Figure 17-3**) and the previous (prehistoric and historic) (**Figure 17-4**) character types for which information is available. The accompanying character texts were used to identify the primary values and perceptions for each character type summarised in **Table 17-15**.

151. A qualification of change since production of the HSC baseline as well as potential changes to the character should the DCO application for DBS East and West be successful is also included in **Table 17-15**.

Table 17-15 Summary of Historic Seascape Character Types

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
Communications	Submarine telecommunications cable	Mapped as a minor character type within the Study Area, crossing the northern corner of DBS West. Submarine telecommunications cables are mostly undetected in the marine environment. However, they are a highly reliable form of transferring information and are critical to our present-day life. They can be perceived as obstacles to certain sea users such as fishermen and dredgers.	No identified change.	As submarine telecommunications cables are mostly undetected in the marine environment it is unlikely that perceptions of this character type will be altered by construction activities or by the presence of installed infrastructure.
Cultural topography	Cultural topography (marine): Coarse sediment plains Fine sediment plains	These marine cultural topographies overall are highly valued due to their biodiversity and habitat range and have high archaeological potential and can contribute to our understanding of past landscape use. These types of	New plans and projects (as described below for the industry character type) have further restricted access to these deposits and the underlying palaeolandscapes (through the physical pres-	The primary perceptions which associate marine cultural topography with high archaeological potential could be further enhanced through the accumulation of publicly available data, including discoveries reported through the

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
	Mixed sediment plains Palaeochannel	seabed sediments each provide distinct preservation conditions for wrecks and implications for the potential form and survival of underlying palaeolandscapes.	ence of cables and foundations, for example) or reduced the extent of deposits, through dredging for example. However, a beneficial impact is the ongoing accumulation of publicly available data acquired as part of the consenting process prior to activities which is considered to be of public value.	protocol for archaeological discoveries during construction activities. As the final design of layouts will take the locations of heritage assets and palaeolandscape features into account, change can potentially be offset by professionally executed and published archaeological studies.
Fishing	Bottom trawling Fishing ground Fixed netting Longlining Pelagic trawling Potting Seine netting	Commercial fishing is a primary cultural and historic character of the Dogger Bank area. Bottom trawling, pelagic trawling and seine netting are characterised within constrained areas within DBS East (and partially into DBS	Bottom trawling was banned within the Dogger Bank Special Area of Conservation (SAC) in June 2022.	Although there will be areas where fishing activities are temporarily displaced as a result of construction works, fishing activities will still be permitted in areas of the offshore development not undergoing construction activities. Similarly, fishing activities will not be prohibited during the

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
		West) and the adjacent offshore export cable corridor in the West Shoal and Dogger Bank sea areas. Mapped fishing grounds are concentrated in the western most section of DBS West. Longlining is mapped within the central area of the offshore export cable corridor, fixed netting in the nearshore section and potting mapped adjacent to the landfall only.		operation phase of DBS, although temporary restrictions may apply during construction and around major maintenance activities.
Industry	Hydrocarbon field (gas) Hydrocarbon installation Hydrocarbon pipeline	The North Sea as a whole has always been important to the energy industry, most notably for its natural oil and gas resources which have been heavily exploited since the 1960s. Gas fields, hydrocarbon installations and pipelines are present within both DBS	The most significant change since compilation of the HSC dataset is the introduction of new offshore wind farms to the north and south of DBS. The Dogger Bank A and Sofa wind farms to the north of DBS are currently under construction with construction of	Overall, perceptions of the North Sea energy industry place greater emphasis upon nuclear power and renewable energy. The HSC states that Britain has the best offshore wind resource in Europe and changing perceptions associated with the construction of DBS are therefore likely to be

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
		East and DBS West. More recently nuclear power and renewable energy sources have become viewed as more important as a result of increasing concerns about CO_2 emissions from energy generation using fossil fuels.	Dogger Bank B due to commence in 2023, followed by Dogger Bank C in 2024. Similarly, to the south, Hornsea Project 1 became fully operational in 2019 and Project 2 in 2022 with Hornsea 3 consented in 2020 and Hornsea 4 having completed examination.	seen as part of this natural progression for energy generation and as a positive change from fossil fuels to renewable energy. This is further qualified by UK climate change policies. Overall, wind turbines are becoming larger and more dispersed representing fewer discrete locations for avoidance in determining the final layouts and maintaining broader access to the seabed within the wind farms themselves, once constructed. This change will be further understood following the acquisition of additional information to inform detailed design post-consent.
Military	Military practice area	Military practice areas are used by the armed forces for training and military exercises and this character type is	No identified change.	It is anticipated that the Projects would not impact on any military activities and there would be no change to the

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
		mapped across DBS West and sections of the offshore export cable corridor. In UK waters there are several designated military practice areas, formally entitled 'Practice and Exercise Areas' (PEXAs), which are in use or available for use by the Ministry of Defence (MoD) for practice and exercises. These include Royal Air Force (RAF) practice areas, submarine exercise areas and firing danger areas. Public access across these areas is only restricted during active exercises.		current character of these areas.

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
Navigation	Navigation activity: Navigation route	Although the region's coastal economy is more strongly perceived for its fishing character, navigation activity is also an important element of the offshore region, with the main port of Hull to the South. For centuries communities have made their living from their proximity to the North Sea and its connecting routes, linking the region to other parts of Britain and to the continent.	No identified change.	Construction and maintenance activities and additional vessel traffic would occur within the context of existing navigation routes in to, and out of, Hull for example. However, this additional traffic is unlikely to be perceived as a material change. It is anticipated that no change to the perception of this character type would occur as a result of construction activities.
	Navigation hazard: Hazardous water Maritime debris Wreck hazard	Historically, the sea has been perceived as a dangerous place which often behaves in unexpected and unpredictable ways. Wrecks have most relevance from their roles as hazards to navigational activity or as indicators of areas	Survey and evaluation for new plans and projects have extended public understanding of these hazards and, in particular, new wrecks and finds have been identified as a direct results of activities. This ongoing accumulation of	The primary perceptions which associate hazardous water, debris and wrecks with local heritage and stories relating to dangers of the high seas, to recreational diving and to wrecks as habitats could be enhanced through

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
		and routes of past navigational, naval or trading activity. For example, the study East Coast War Channels in the First and Second World War (Firth, 2014), examines the spatial extent of navigation channels and minefields between the Thames and the Scottish border during both wars and the heritage assets that are associated with these channels. Hazardous water includes wrecks and other hazards such as submerged rocks, shoal or flats. Navigational hazards have always been a preoccupation for sailors, but they became prominent in people's consciousness, including in tales and myths,	publicly available data acquired as part of the consenting process is considered to be of public value.	the provision of publicly available data on seabed features identified during geophysical survey, and in the event of unexpected discoveries reported through the protocol for archaeological discoveries during construction activities. During operation, the Projects may result in a change to the perception of navigational hazards on the basis that the introduction of wind turbines represents additional navigation hazards. They are, however, equipped with navigational features such as warning lights. On this basis, this character sub-types are considered to have the capacity to accommodate this level of change.

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
		evoking rhymes and songs, due to the danger associated within them. Wrecks, although fatal for many, added to the local heritage of stories about dangers on the high seas. They are also now perceived as recreational opportunities, with many wrecks dived by both amateur dive groups and professional organisations. Many wrecks are also valued for their strong contribution to habitat diversity and by the fishing community as they attract certain prey specifies. See section 17.5.2 for detail on wrecks within the Study Area.		

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
Recreation	Leisure sailing	The nearshore export cable corridor is mapped as an area characterised by Leisure Sailing. As described in Chapter 29 Tourism and recreation, for most of the northeast coast, there is very little recreational boating within the coastal area around Creyke Beck. Recreational vessel usage is generally low in the region, and offshore recreational vessel usage is very low, almost absent.	No identified change.	Short term construction activities in the nearshore export cable corridor, and the presence of landfall infrastructure and offshore export cables, which will be undetectable once installed and therefore not perceived by the public, are considered unlikely to result in a meaningful change to the perceived character of leisure sailing.
Previous character types	Palaeolandscape component - Mesolithic (10,000BC – 4000BC)	Within the Study Area, the HSC maps areas of high, medium and low potential for the existence and survival of archaeological evidence for Mesolithic human habitation	As stated for the cultural topography character type above, new plans and projects have further restricted access to these deposits and	There is the potential for positive enhancement of primary perceptions associated with a growing interest in submerged landscapes through the provision of publicly available data

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
		based on documentary research and available models (Figure 17-3). In England, growing interest in submerged landscapes fuelled by the media and popular culture is increasing the value placed on these offshore palaeolandscapes. In particular there is a developing interest within certain sectors of society who come into contact with the resource (e.g. fishermen and aggregate dredgers). Submerged landscapes are becoming ever more recognised and valued within the archaeological community. See section 17.5.1 for detail on submerged prehistoric landscapes within the Study Area.	the underlying palaeolandscapes (through the physical presence of cables and foundations, for example) or reduced the extent of deposits, through dredging for example. However, a beneficial impact is the ongoing accumulation of publicly available data acquired as part of the consenting process which is considered to be of public value.	on palaeolandscapes following the further archaeological and geoarchaeological assessment of survey data. As the final design of layouts will take palaeolandscapes into account, this change can be offset by the accumulation of publicly available data acquired by the Projects prior to construction which is considered to be of public value.

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
	Bottom trawling - Early Modern (AD1750 – 1900) Fishing ground - Medieval (AD1066 – 1540) Fixed netting - Early Modern (AD1750 – 1900) Longlining - Post Medieval (AD1540 – 1750) Pelagic trawling -Early	Historic character types associated with the commercial fishing activities described above are mapped throughout the Study Area (Figure 17-4). The HSC makes specific reference within the Study Area to: Cod fished around Dogger Bank during the 14th century. Documentary sources suggest longlining activities took place off the Dogger Bank during the 18th century. Historically, longlining for white fish from cobles was the most common fishing activity in the North East. Inshore vessels mainly cobbles. Set Netting and lining. Haddock, Whiting, Coalfish, Pollack, Wrasse, and Cod	Bottom trawling was banned within the Dogger Bank Special Area of Conservation (SAC) in June 2022.	As stated for the fishing character types above, the presence of the wind far infrastructures is not anticipated to fundamentally alter perceptions of the historic fishing industry. The distance of the DBS East and DBS West wind farm sites from the coast, and the minimal above ground infrastructure at the coast, means that the Projects will be largely undetectable by the public and historic perceptions of the traditional fishing industry, which the HSC described as having taken on a 'quaint' character, a memory of better days, will remain largely unchanged.

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
	Modern (AD1750 – 1900) Seine netting - Post Medieval (AD1540 – 1750)	Beam trawlers worked the Yorkshire coast in the 19th century		
	Naval battle-field -Medieval (AD1066 – 1540) Early Modern (AD1750 – 1900)	Within the Study Area, the HSC maps the site of several naval actions including the Battle of Dogger Bank in 1781, the Russo-Japanese war in 1904 and the WW1 second Battle of Dogger Bank	With the archaeological assessment of offshore survey data there is a growing body of data on military wrecks and aircraft and adjacent military installations along the coast and on the foreshore. The ongoing accumulation of publicly available data acquired as part of the consenting process is considered to be of public value.	There is the potential for positive enhancement through the provision of publicly available data on the wider setting and character of 20th century military activity within the Study Area.

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
	Navigation route -Medieval (AD1066 – 1540)	Coastal navigation routes are known to have existed through the Study Area from at least the medieval period, mapped as part of the ALSF funded England's Shipping project in 2007 which used GIS to map historic shipping movements recorded in historical archives. During the medieval period trading networks expanded across Europe and these coastal trade routes were fundamental to the connection of north-east England with this European trade. Although the routes themselves are not necessarily represented by tangible remains, and are not easily appreciated by people observing the sea from land, these historic routes are often	No identified change.	As stated for the navigation route character type above, construction and maintenance activities and additional vessel traffic would occur within the context of existing navigation routes in to, and out of, Hull for example. However, this additional traffic is unlikely to be perceived as a material change. It is anticipated that no change to the perception of this character type would occur as a result of construction activities.

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
		associated with increased potential for wrecks and local accounts of historic wrecking events, with coastal vessels driven on to shore and lost in storms, for example.		

17.5.5 Future Trends

152. In the event that the Projects are not developed, an assessment of future conditions for Offshore Archaeology and Cultural Heritage has been carried out and is described within this section.

153. The existing environment for Offshore Archaeology and Cultural Heritage has been shaped by a combination of factors, with the most prevalent being changes in global sea levels and associated climatic and environmental conditions which have affected the burial and preservation of prehistoric archaeology, and latterly that of maritime and aviation archaeology. Historic England (2022) recognise, 'that the marine and inter-tidal zones are dynamic and have always undergone natural environmental change and changing patterns of use and exploitation which are nothing new'.

154. Cycles of burial and exposure resulting from marine physical processes, including storm events which can result in the stripping of shallow sediment from the seabed and beach, have an ongoing effect upon the preservation of archaeological material. Exposed heritage assets are at greater risk from erosion and degradation as a result of the effects of physical processes than those which remain buried and are consequently provided with greater protection from continued sediment cover. These cycles of burial and exposure are anticipated to continue although the effect upon individual heritage assets is difficult to predict as this will depend upon site specific conditions and the nature of any exposed archaeology.

155. As outlined in **Chapter 8 Marine Physical Environment** (section 8.8) the baseline conditions for marine physical processes will continue to be controlled by waves and tidal currents driving changes in sediment transport and then seabed morphology, as well as anthropogenic influences in relation to water quality. These long-term drivers may be affected by environmental changes including climate change driven sea-level rise. This will have the greatest impact at the coast where more waves will impinge on the cliffs, potentially increasing their rate of erosion. Climate change will have little effect offshore where landscape-scale changes in water levels (water depths) far outweigh the effect of minor changes due to sea-level rise.

156. Consequently, future trends in terms of marine physical processes suggest that continued erosion will result in further loss of archaeological material eroding from the cliffs in the long term.

157. In addition, survey and evaluation associated with the increased number of offshore development projects in recent years, and finds encountered as a result of activities, create new opportunities for discovery. However, this increasing awareness of the marine historic environment is accompanied by a heightened awareness of the threats from vandalism, the theft of artefacts or the non-disclosure of removed artefacts from shipwrecks. Archaeological protocols for commercial activity mean that finds from the dredging, fishing and offshore renewables industries are now routinely reported. Historic England (2022) also recognize the need for, 'new ways of engaging the public through developing dive trails, by community engagement and raising awareness through the latest technology, allowing non-divers and non-specialists to access information on maritime heritage'.

17.6 Assessment of Significance

17.6.1 Potential Effects During Construction

17.6.1.1 Impact 1 Direct (Physical) Impact to Known Heritage Assets

158. Direct (physical) impacts, as stated in the NPS for Renewable Energy Infrastructure (EN-3) (Department of Energy and Climate Change (DECC) 2011b: 49, BEIS 2021b: 59), encompass direct effects from the physical siting of the Projects. Direct impacts to heritage assets, either present on the seafloor or buried within seabed deposits, may result in damage to, or total destruction of, archaeological material or the relationships between that material and the wider environment (stratigraphic context or setting). These relationships are crucial to developing a full understanding of an asset. Such impacts may occur if heritage assets are present within the footprint of elements of DBS (i.e. foundations or cables) or within the footprint of activities such as seabed clearance, anchoring or the placement of jack up barges.

159. There are no known seabed prehistory or aviation sites within the offshore archaeology study area.

160. As described in section 17.5.2, there are 14 records of previously recorded wrecks which are considered 'live' and likely to comprise physical remains of archaeological interest, or possible archaeological interest. In addition there are two items of debris recorded which may also be of archaeological interest (UKHO ID 99482, possible anchor or fishing gear and UKHO ID 99468, possible debris or foul ground).

161. There is potential for direct impact to these features during the following activities:

- Seabed preparation (including UXO and boulder clearance, where required);
- Installation of wind turbine foundations and foundations for other offshore infrastructure;
- Installation of ancillary infrastructure;
- Installation of offshore cabling; and
- Seabed contact by legs of jack-up vessels and / or anchors.

162. The remaining records correspond to modern wrecks or debris, to natural features or to locations where the presence or absence of anthropogenic material is less certain. For the purposes of this PEIR, these records are considered as potential heritage assets, discussed in section 17.6.1.3. The presence or absence of any archaeological material at the recorded positions will be clarified through the archaeological assessment of marine geophysical data by Wessex Archaeology, the results of which will be presented in the ES.

163. Within the intertidal zone (see section 17.5.3), known heritage assets comprise an organic deposit in the Ulrome Cliffs (Humber HER 18037) and the fragmented remains of former WWII coastal defences observed during the heritage walkover survey (**Appendix 22-3**).

164. Until the final design and layouts are confirmed, there will remain uncertainty in the precise nature and extent of any direct impacts. However, it is anticipated that all such remains could be avoided through the use of HDD, or other trenchless techniques, to install the cable ducts, passing below the beach deposits. In this instance there will be no direct pathway for impact to known intertidal assets. However, should an exit in the intertidal zone be selected there would be potential for direct impact to known intertidal assets.

165. The depth of sedimentary sequences of archaeological interest at the landfall will be further clarified through the geoarchaeological assessment of geotechnical data post-consent, and will inform the design of HDD and nearshore cable installation.

17.6.1.1.1 Magnitude of Impact – DBS East or DBS West in Isolation

166. Installation of the cables at the landfall will be undertaken via trenchless techniques. Should an exit in the intertidal zone be selected then the location of all known remains on the beach will be avoided by the means of intertidal AEZs which will be agreed in consultation with Historic England.

167. With regard to known wrecks and debris, all direct impacts that result in damage to, or disturbance of, a feature will be adverse, permanent and irreversible. The 'fabric' of the asset and, hence, its potential to inform our historical understanding, will be removed.

168. Until the final design and layout is confirmed, there will remain uncertainty in the precise nature and extent of any direct impacts, should they occur within either DBS East or DBS West.

169. Therefore, with the application of a precautionary approach, it is necessary to assess the worst case scenario which assumes that, if any of the seabed features are directly impacted, key elements of the asset's fabric and / or setting could be lost or fundamentally altered, such that the asset's heritage significance is lost or severely compromised. Therefore, in accordance with the definitions set out in **Table 17-7**, without mitigation, there is potential for direct impacts of high adverse magnitude for any of the identified features.

17.6.1.1.2 Magnitude of Impact – DBS East and DBS West Together

170. As above, until the final design and layouts are confirmed, there will remain uncertainty in the precise nature and extent of any direct impacts, should they occur within both DBS East and DBS West. Therefore, without mitigation, there is potential for direct impacts of high adverse magnitude for any of the identified wrecks and features.

17.6.1.1.3 Sensitivity of Receptor

171. The heritage importance (sensitivity) of identified assets is set out in sections 17.5.1.3, 17.5.2.3 and 17.5.3.3.

172. As there are no known seabed prehistory or aviation sites within the offshore archaeology study area, direct (physical) impacts to known heritage assets are limited to impacts to previously recorded wrecks and debris, the importance of which is assessed as follows:

- The wreck *Feltre* (UKHO ID 6470 / NRHE ID 907939) is of medium importance.
- The 13 unidentified wrecks are of high importance (as a precautionary measure).
- Isolated items of debris including the possible anchor (UKHO ID 99482) and possible debris (UKHO ID 99468) are of medium importance.

17.6.1.1.4 Significance of Effect – DBS East or DBS West in Isolation

173. In accordance with the significance of effect matrix (**Chapter 6 EIA Methodology, Table 6-6**) without mitigation, should impacts occur within either DBS East or DBS West in isolation, these have the potential to be of major adverse significance.

17.6.1.1.5 Significance of Effect – DBS East and DBS West Together

174. The potential significance of effect for direct (physical) impacts to known heritage assets, without mitigation, is the same for DBS East and DBS West as for DBS East or DBS West in isolation (i.e. any direct impacts have the potential to be of major adverse significance).

17.6.1.1.6 Mitigation and Residual Significance of Effect – DBS East or DBS West in Isolation

175. With the application of mitigation, it is anticipated that all direct impacts to known heritage assets as a result of DBS East or DBS West can be avoided.

176. Following completion of the archaeological assessment of marine geophysical data, AEZs will be implemented around the extents of known wreck sites, marine geophysical anomalies of archaeological interest and previously recorded sites at which the presence of surviving material is considered possible. No development related activities will take place within an AEZ.

177. For the purposes of PEIR, AEZs (comprising 100m buffers around the recorded point locations) are recommended for the 14 wrecks and two recorded items of debris at which the presence of archaeological material is considered likely.

178. AEZs are not recommended for the remaining 62 records which, as set out in section 17.5.2, correspond to modern wrecks or debris, to natural features or to locations where the presence or absence of anthropogenic material is less certain.

179. Five of the records which correspond to 'modern' wrecks, a recent loss of a cargo of iron bars and a modern pipeline are not of archaeological interest. Although AEZs are not assigned to these features, avoidance may still be warranted for operational reasons and the positions should be noted to inform the final design. The remaining 55 records are considered as potential heritage assets, discussed in section 17.6.1.3.

180. The nature and extent of these AEZs (including any recommendations for further AEZs around newly identified features of archaeological interest) will be refined following completion of the archaeological assessment of marine geophysical data with the outcomes presented in the ES. Similarly, the

distribution of features of possible archaeological interest, as seen in the geophysical data, will also be identified in the ES.

181. AEZs may be reduced, enlarged or removed in agreement with Historic England if further relevant information becomes available. However, unless modified by agreement, it is important that AEZs are retained throughout the lifetime of DBS East and DBS West and monitoring of AEZs may be required by the regulator and Historic England to ensure adherence both during construction and in the future operation of the wind farms.

182. The archaeological assessment of pre-construction survey data, including high resolution geophysical data undertaken for the purposes of UXO identification, will further clarify the nature and extent of any additional anomalies of possible archaeological interest and the scheme design will be modified (micro-sited) to avoid heritage assets where possible.

183. If features cannot be avoided, then additional work may be required (to be undertaken post-consent) to establish the archaeological interest of the feature (e.g. investigation of individual anomalies (ground truthing) through ROV and / or diver survey). Once the character, nature and extent of selected features are more fully understood, appropriate mitigation measures (proportionate to the significance of the asset) to reduce or off-set impacts can be determined on a case by case basis.

184. The approach to the implementation of these mitigation measures will be set out in an Outline WSI (Offshore) which will be submitted alongside the ES and DCO application. The WSI will be prepared in accordance with industry standards and guidance including Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021).

185. With the application of AEZs and micro-siting to avoid additional anomalies of possible archaeological interest, direct impacts to known heritage assets will be avoided, and there will be no impact during construction.

186. Where micro-siting is not possible, and therefore where additional mitigation will be required, it is anticipated that the residual magnitude and significance can be reduced or offset so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a minor adverse significance).

17.6.1.1.7 Mitigation and Residual Significance of Effect – DBS East and DBS West Together

187. The application of mitigation (as detailed above) will be the same for the construction of both DBS East and DBS West, as for either Project built in isolation. Therefore, with the application of mitigation it is anticipated that the residual magnitude and significance can be reduced or offset so that

effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a minor adverse significance).

17.6.1.2 Impact 2 Direct Impact to Potential Heritage Assets

188. It is not possible to avoid heritage assets that have not yet been discovered (potential heritage assets). Therefore, unavoidable direct impacts may occur if archaeological material is present within the footprint of the Projects associated with the following activities:

- Seabed preparation (including UXO and boulder clearance, where required);
- Installation of wind turbine foundations and foundations for other offshore infrastructure;
- Installation of ancillary infrastructure;
- Installation of offshore cabling;
- Seabed contact by legs of jack-up vessels and / or anchors; and
- Cable installation at the landfall.

189. For the purpose of this assessment, potential heritage assets are regarded as comprising the following asset types:

- Potential in situ prehistoric sites, submerged landscape features, derived / isolated Prehistoric finds and palaeoenvironmental evidence;
- Potential wrecks and derived / isolated maritime finds and specifically archaeological material relating to:
  - Nine records representing the locations of 'dead' wrecks;
  - 12 records which are probable natural features;
  - 11 records which note the positions of obstructions reported by fisherman;
  - 18 records corresponding to wrecks shown on Danish Fisheries Chart 5400 (1965 edition) which have not subsequently been surveyed by the UKHO; and
  - records documenting reported locations of loss.
- Potential aircraft and derived / isolated aviation finds; and
- Potential intertidal finds and *in situ* features within the cliff face.

17.6.1.2.1 Magnitude of Impact – DBS East or DBS West in Isolation

190. Within the intertidal zone, the use of trenchless installation techniques, with entry on the landward side of the cliffs, and exit below MLWS in the marine zone, would mean that impacts to potential intertidal archaeological material will be avoided. It is anticipated that HDD will pass beneath Quaternary deposits of potential archaeological interest and therefore, no impact will occur. However, should an exit in the intertidal zone be selected there would be potential for direct impact to archaeological material, if present, buried within beach deposits.

191. All direct impacts that result in damage to, or disturbance of, in situ prehistoric, maritime and aviation sites and potential submerged landscape features and potential palaeoenvironmental evidence (where associated with palaeolandscape features or archaeological material) would be adverse, permanent and irreversible. The 'fabric' of the asset and, hence, its potential to inform our historical understanding, will be removed.

192. In practice, the magnitude of the effect will not be fully understood until after the potential heritage asset has been encountered and the impact has occurred. The extent of any impact will depend on the presence, nature and depth of any such remains, in association with the depth, location and nature of construction-related groundworks and contact with the seabed. However, as a precautionary approach, it should be assumed that key elements of the asset's fabric could be lost or fundamentally altered, such that the asset's heritage significance is lost or severely compromised Therefore, in accordance with the definitions set out in **Table 17-7**, without mitigation, there is potential for direct impacts of high adverse magnitude upon potential in situ heritage assets.

193. Isolated / derived artefacts, either of prehistoric, maritime or aviation origin within reworked deposits may be considered less sensitive to change than in situ material, as their relationship with their context or physical setting is less relevant to understanding their significance. Therefore, in accordance with the definitions set out in **Table 17-7**, without mitigation, there is potential for direct impacts of low adverse magnitude upon potential isolated finds. Should such finds be encountered during construction activities, although removal from the marine context will still result in the destruction of that contextual relationship, albeit a secondary context (i.e. not in situ), isolated artefacts have capacity to accommodate physical changes, therefore resulting in only a slight loss of heritage significance.

17.6.1.2.2 Magnitude of Impact – DBS East and DBS West Together

194. As above, as the magnitude of the effect will not be fully understood until after the potential heritage asset has been encountered and the impact has occurred there is no difference between the potential magnitude of effect for DBS East and DBS West together, compared with DBS East and DBS West in isolation. Therefore, without mitigation, and as a precautionary approach, there is potential for direct impacts of high adverse magnitude upon potential in situ heritage assets. Potential impacts upon isolated finds will be of low adverse magnitude.

17.6.1.2.3 Sensitivity of Receptor

195. The heritage importance (sensitivity) of potential heritage assets is set out in sections 17.5.1.3, 17.5.2.3 and 17.5.3.3.

196. As a precautionary measure all potential in situ sites are assessed as being of high importance whilst all isolated finds are of medium importance and isolated examples of palaeoenvironmental material of low importance.

17.6.1.2.4 Significance of Effect – DBS East or DBS West in Isolation

197. In accordance with the significance of effect matrix (**Chapter 6 EIA Methodology, Table 6-6**) without mitigation, should impacts occur to in situ sites within either DBS East or DBS West in isolation, these have the potential to be of major adverse significance.

198. Should isolated / derived finds in secondary contexts, or isolated examples of palaeoenvironmental material be encountered during construction activities, impacts will be of potential minor adverse significance.

17.6.1.2.5 Significance of Effect – DBS East and DBS West Together

199. The potential impact significance for direct (physical) impacts to potential heritage assets, without mitigation, is the same for DBS East and DBS West together as for DBS East and DBS West in isolation (i.e. any direct impacts upon in situ heritage assets have the potential to be of major adverse significance while direct impacts upon isolated finds, or isolated examples of paleoenvironmental material, will be of potential minor adverse significance).

17.6.1.2.6 Mitigation and Residual Significance of Effect – DBS East or DBS West in Isolation

200. Further archaeological assessment of high-resolution geophysical data and geoarchaeological assessment of geotechnical data will be undertaken post-consent in order to reduce, as far as possible, the potential for unintended impacts during construction.

201. If in situ prehistoric sites are identified as a result of such work then mitigation measures to record and / or protect such sites would be agreed in consultation with Historic England.

202. Similarly, planned pre-construction surveys will result in full coverage of the areas within which construction will take place (corresponding to the final wind farm layout and cable route) with high resolution SSS, MBES and magnetometer data. If features of archaeological interest are identified during these, they will be subject to the same mitigation as described for known heritage assets (see section 17.6.1.1.6).

203. Although measures will be taken to reduce, as far as possible, the potential for impact to previously undiscovered heritage assets it is still possible that unexpected discoveries may be encountered during construction. However, measures are possible to further reduce the significance of potential impacts by ensuring that prompt archaeological advice is received in the event of a discovery and by recording and conserving any objects that have been disturbed.

204. In the event of an unexpected discovery of an isolated find, or where discoveries of multiple chance finds from a specific location might be indicative of a wider debris field representing previously unknown in situ archaeological material, this will be reported through a formal protocol for archaeological discoveries. This will be based upon the established Protocol for Archaeological Discoveries: Offshore Renewables Projects (The Crown Estate, 2014) (ORPAD). This will establish whether the recovered objects are of archaeological interest and allow for the application of appropriate mitigation measures, where necessary. For any new discoveries, any further mitigation which may be required would be considered on a case by case basis, proportionate to the significance of the discovery.

205. The approach to the implementation of these mitigation measures will be agreed in consultation with Historic England in accordance with industry standards and guidance and set out in the Outline WSI.

206. Therefore, with the application of mitigation it is anticipated that the residual magnitude and significance can be reduced or offset so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a minor adverse significance).

17.6.1.2.7 Mitigation and Residual Significance of Effect – DBS East and DBS West Together

207. As impacts to potential heritage assets cannot be avoided, the worst case for direct impact is based upon the general assumption that the greatest potential footprint for the Projects represents the greatest potential for

direct impacts (e.g. damage / destruction) to surviving archaeological material. The combined footprint of both Projects, therefore, represents a greater potential for direct impacts than if, for example, only DBS East or DBS West was to be built in isolation.

208. However, the application of mitigation, comprising further assessment and investigation post-consent, and the application of the protocol for archaeological discoveries to ensure that prompt advice is received in the event of an unexpected discovery, will be the same for the construction of both DBS East and DBS West, as for either Project being built in isolation.

209. Therefore, with this mitigation it is anticipated that the residual magnitude and significance can be reduced or offset so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a minor adverse significance).

17.6.1.3 Impact 3 Indirect Impact to Heritage Assets from Changes to Physical Processes

210. The Project also has the potential to interact with both local and regional hydrodynamic and sedimentary processes which in turn may result in impacts of an indirect (physical) nature occurring upon heritage assets. Changes in coastal processes can lead to re-distribution of erosion and accretion patterns while changes in tidal currents, for example, may affect the stability of nearby morphological and archaeological features. Indirect impacts to heritage assets may occur if buried heritage assets become exposed to marine processes, due to increased wave / tidal action for example, as these will deteriorate faster than those protected by sediment cover. Conversely, if increased sedimentation results in an exposed site becoming buried this may be considered a beneficial impact.

211. The potential indirect impact to heritage assets from changes to physical processes is assessed with reference to section 8.9.3 (Potential Effects During Construction) of **Chapter 8 Marine Physical Environment**.

212. With regard to Impact 3 (changes to bedload sediment transport due to landfall HDD works), Chapter 8 determines that there would be no long-term effect on sediment transport processes from construction. Localised and short-term disturbance to the beach and nearshore zone would correspond to the same footprint as direct impacts discussed above. Similarly, with respect to the Impact C4 (indentations on the seabed due to installation vessels), as it is only sediments within the immediate vicinity of the leg that will be impacted, it is also only heritage assets within the footprint of the legs that will be impacted (with no change in the near- and / or far-field). As this corresponds to the same footprint as the direct impacts

discussed above, these indirect impacts are considered to equate to the same conclusions and mitigation as presented above and are not considered further.

213. Marine physical processes impacts which correspond to increased seabed level, and, therefore, increased potential for the protection of heritage assets which are currently exposed through additional sediment cover (sediment deposited from plume) are:

- Impact C2a: Changes in seabed level due to seabed preparation for foundation installation;
- Impact C2b: Changes to seabed level due to drill arisings from foundations; and
- Impact C2c: Changes in seabed level due to cable installation.

17.6.1.3.1 Magnitude of Impact – DBS East or DBS West in Isolation

214. The magnitude of impacts of marine physical processes from **Chapter 8 Marine Physical Environment** which correspond to increased seabed level, and, therefore, increased potential for the protection of heritage assets which are currently exposed through additional sediment cover (sediment deposited from plume) are set out in **Table 17-16**.

Table 17-16: Magnitude of Impact on Seabed Level Under the Worst Case Scenario for Chapter 8 Marine Physical Environment

Location	Scale	Duration	Frequency	Reversibility	Magnitude of impact
Impact C2a: Changes in seabed level due to seabed preparation for foundations					
Near-field	Medium	Negligible	Negligible	Negligible	Low
Far-field	Negligible	Negligible	Negligible	Negligible	Low
Impact C2b: Changes to seabed level due to drill arisings from foundations					
Near-field	Medium	Negligible	Negligible	Negligible	Low
Far-field	Negligible	Negligible	Negligible	Negligible	Negligible
Impact C2c: Changes in seabed level due to cable installation					
Near-field	Low	Negligible	Negligible	Negligible	Negligible
Far-field	Negligible	Negligible	Negligible	Negligible	Negligible

215. Based upon the assessment of marine physical process, the indirect far-field effect upon the burial of heritage assets will be negligible and will not result in a measurable change to the preservation of heritage assets. Similarly, although short term changes will occur near-field, the low magnitude (as a worst-case) combined with the temporary nature of such changes, which will be largely confined to the vicinity of the offshore infrastructure, are not anticipated to result in a measurable change to the burial of heritage assets should they be present.

216. The indirect effect of changes to marine physical process upon offshore heritage assets, therefore, is concluded to result in no impact.

17.6.1.3.2 Magnitude of Impact – DBS East and DBS West Together

217. Section 8.9.3 (Potential Effects During Construction) of **Chapter 8 Marine Physical Environment** concludes that for all elements, the change in seabed levels for DBS East and DBS West together will be similar or the same to that outlined for DBS East and DBS West in isolation. Therefore, the indirect effect of changes to marine physical process upon offshore heritage assets is also concluded to result in no impact.

17.6.1.3.3 Sensitivity of Receptor

218. The heritage importance (sensitivity) of potential heritage assets is set out in sections 17.5.1.3, 17.5.2.3 and 17.5.3.3.

17.6.1.3.4 Significance of Effect – DBS East or DBS West in Isolation

219. As the magnitude of impact is concluded to be no impact the significance will be no change.

17.6.1.3.5 Significance of Effect – DBS East and DBS West Together

220. As the magnitude of impact is concluded to be no impact the significance will be no change.

17.6.1.4 Impact 4 Changes to the Setting of Heritage Assets

221. As part of the settings assessment undertaken in relation to onshore heritage assets, **Chapter 22 Onshore Archaeology and Cultural Heritage** has concluded that any changes in setting due to construction activities will be temporary and of sufficiently short duration that they would not give rise to material harm. The same conclusions are considered as applicable to marine and intertidal heritage assets and as such, indirect (non-physical) impacts upon the setting of such assets during the construction phase have therefore also been excluded from further consideration (no impact).

17.6.2 Potential Effects During Operation

17.6.2.1 Impact 1 Direct (Physical) Impact to Known Heritage Assets

222. As all known heritage assets will be avoided through the retention of AEZs throughout the lifetime of DBS East and DBS West, there is no pathway for impact during routine or unscheduled maintenance activities.

17.6.2.2 Impact 2 Direct (Physical) Impact to Potential Heritage Assets

17.6.2.2.1 Magnitude of Impact – DBS East or DBS West in Isolation

223. Direct impacts to potential heritage assets are unlikely to occur as a result of intrusive maintenance as any impacts would already have occurred during installation of the wind farm infrastructure during the construction phase and been subject to appropriate and proportionate additional mitigation measures, as and where necessary. There will be no impact at the landfall during the operational phase as there will be no groundworks within or disturbance of intertidal deposits.

224. There is, however, potential for impacts to occur if archaeological material is present within the footprint of jack-ups or vessel anchors deployed during planned or unscheduled maintenance activities, if these are located in areas which were not previously subject to disturbance. In practice, the nature and extent of individual impacts cannot be fully understood until after the impact has occurred. Therefore, as for construction activities, and as a worst case, there is potential for direct impacts of high adverse magnitude upon potential in situ heritage assets and low adverse magnitude upon potential isolated finds.

17.6.2.2.2 Magnitude of Impact – DBS East and DBS West Together

225. As above, as the magnitude of the impact will not be fully understood until after the potential heritage asset has been encountered and the impact has occurred there is no difference between the potential magnitude of impact for DBS East and DBS West together, compared with DBS East or DBS West in isolation. Therefore, without mitigation, and as a precautionary approach, there is potential for direct impacts of high adverse magnitude upon potential in situ heritage assets and low adverse magnitude upon potential isolated finds.

17.6.2.2.3 Sensitivity of Receptor

226. The heritage importance (sensitivity) of potential heritage assets is set out in sections 17.5.1.3, 17.5.2.3 and 17.5.3.3.

227. As a precautionary measure all potential in situ sites are assessed as being of high importance whilst all isolated finds are of medium importance and isolated examples of palaeoenvironmental material of low importance.

17.6.2.2.4 Significance of Effect – DBS East or DBS West in Isolation

228. In accordance with the significance of effect matrix (**Chapter 6 EIA Methodology, Table 6-6**) without mitigation, should impacts occur to in situ sites within either DBS East or DBS West in isolation, these have the potential to be of major adverse significance.

229. Should isolated / derived finds in secondary contexts, or isolated examples of palaeoenvironmental material, be encountered during construction activities, impacts will be of potential minor adverse significance.

17.6.2.2.5 Significance of Effect – DBS East and DBS West Together

230. The potential impact significance for direct (physical) impacts to potential heritage assets, without mitigation, is the same for DBS East and DBS West together as for DBS East and DBS West in isolation (i.e. any direct impacts upon in situ heritage assets have the potential to be of major adverse significance while direct impacts upon isolated finds will be of potential minor adverse significance).

17.6.2.2.6 Mitigation and Residual Significance of Effect – DBS East or DBS West in Isolation

231. The archaeological assessment of post-construction monitoring data will further reduce, as far as possible, the potential for unintended impacts during operation. If further features of archaeological interest are identified these will be subject to the same mitigation as described for known heritage assets described in in section 17.6.1.1.6 above with the primary approach being avoidance.

232. In the event of an unexpected discovery, the ongoing implementation of a formal protocol for archaeological discoveries, throughout the operation phase, will allow for such discoveries to be efficiently reported, for advice to be provided and for any further mitigation to be considered on a case by case basis, proportionate to the significance of the discovery.

233. The approach to the implementation of these mitigation measures will be set out in the Outline WSI.

234. Although the precise nature of the impact, and the heritage significance of any material impacted, cannot be fully understood until the impact has occurred, it is anticipated that with mitigation the residual magnitude and significance can be reduced or offset so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a minor adverse significance).

17.6.2.2.7 Mitigation and Residual Significance of Effect – DBS East and DBS West Together

235. The combined footprint of potential jack-up and anchor locations during operation for both Projects represents a greater potential for direct impacts than if, for example, only DBS East or DBS West was to be built in isolation. However, the application of a formal protocol for archaeological discoveries to ensure that prompt advice is received in the event of an unexpected discovery, will be the same for the construction of both DBS East and DBS West, as for either Project being built in isolation. Therefore, with the application of mitigation it is anticipated that the residual magnitude and significance can be reduced or offset so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a minor adverse significance).

17.6.2.3 Impact 3 Indirect Impact to Heritage Assets from Changes to Physical Processes

236. The potential indirect impact to heritage assets from changes to physical processes is assessed with reference to section 8.9.4 (Potential Effects During Operation) of **Chapter 8 Marine Physical Environment**.

237. For Impact O6 (indentations on the seabed due to installation vessels), because only sediments within the immediate vicinity will be impacted, only heritage assets within the footprint will be impacted (with no change in the near- and far-field). As this corresponds to the same footprint as the direct impacts discussed above, this indirect impact is considered to equate to the same conclusions and mitigation as presented above and is not considered further.

238. Marine physical processes impacts which correspond to changes which could result in scour and sediment stripping across the study area, and the exposure and increased degradation of heritage assets which are currently buried and protected from marine processes, are as follows:

- Impact O1 Changes to tidal regime due to the presence of infrastructure (wind turbines and offshore platforms);
- Impact O2 Changes to wave regime due to the presence of infrastructure (wind turbines, and offshore platforms);
- Impact O4a Changes to bedload sediment transport and seabed morphology due to the presence of infrastructure;
- Impact O4b Changes to bedload sediment transport and seabed morphology due to the presence of cable protection measures; and
- Impact O5 Cable repairs and reburial.

17.6.2.3.1 Magnitude of Impact – DBS East or DBS West in Isolation

239. The magnitude of impacts for the marine physical processes impacts from **Chapter 8 Marine Physical Environment** which correspond to changes which could result in scour and sediment stripping across the study area, and the exposure and increased degradation of heritage assets which are currently buried and protected from marine processes,) are set out in **Table 17-17.**

Table 17-17: Magnitude of Impact During Operation Under the Worst Case Scenario for Chapter 8 Marine Physical Environment

Location	Scale	Duration	Frequency	Reversibility	Magnitude of impact
Impact O1 Changes to tidal regime due to the presence of infrastructure (wind turbines and offshore platforms)					
Near-field	Low	High	Medium	Negligible	Low
Far-field	Negligible	High	Medium	Negligible	Negligible
Impact O2 Changes to wave regime due to the presence of infrastructure (wind turbines and offshore platforms)					
Near-field	Low	High	Medium	Negligible	Low
Far-field	Negligible	High	Medium	Negligible	Negligible
Impact O4a Changes to bedload sediment transport and seabed morphology due to the presence of infrastructure					
Near-field	Low	High	Medium	Negligible	Low
Far-field	Negligible	High	Medium	Negligible	Negligible
Impact O4b Changes to bedload sediment transport and seabed morphology due to the presence of cable protection measures					
Inshore of closure depth	Negligible	High	High	Negligible	Negligible
Offshore of closure depth	Low	High	High	Negligible	Low
Impact 5 Cable repairs and reburial					
Near-field	Low	Negligible	Negligible	Negligible	Negligible
Far-field	Negligible	Negligible	Negligible	Negligible	Negligible

240. Based upon the assessment of marine physical process, therefore, the indirect effects of these changes will be negligible, or low, as a worst case, and will not result in a measurable change to the preservation of heritage assets.

241. The indirect effect of changes to marine physical process upon offshore heritage assets, therefore, is concluded to result in no impact.

17.6.2.3.2 Magnitude of Impact – DBS East and DBS West Together

242. Section 8.9.4 (Potential Effects During Operation) of **Chapter 8 Marine Physical Environment** concludes that for all elements, the changes in marine physical processes for DBS East and DBS West together will be similar or the same to that outlined for DBS East and DBS West in isolation. Therefore, the indirect effect of changes to marine physical process upon offshore heritage assets is also concluded to result in no impact.

17.6.2.3.3 Sensitivity of Receptor

243. The heritage importance (sensitivity) of potential heritage assets is set out in sections 17.5.1.3, 17.5.2.3 and 17.5.3.3.

17.6.2.3.4 Significance of Effect – DBS East or DBS West in Isolation

244. As the magnitude of impact is concluded to be no impact the significance will be no change.

17.6.2.3.5 Significance of Effect – DBS East and DBS West Together

245. As the magnitude of impact is concluded to be no impact the significance will be no change

17.6.2.4 Impact 4: Changes to the Setting of Heritage Assets

246. During the operational life of DBS East and DBS West the presence of the wind turbines and offshore platforms will introduce a clear change to the setting of offshore assets. However, as assessed in sections 17.5.1.2 and 17.5.2.2, the setting of marine heritage assets is not considered to form a key part of their significance, which lies primarily in their historical and research value. Furthermore, the baseline setting is already influenced by passing vessels in this area associated with industry, fishing and recreation, thereby reducing the potential magnitude of impact from the presence of vessels, personnel and infrastructure associated with maintenance activities, for example. The significance of effect would, therefore, be negligible adverse as the setting will change in a way which does not materially affect its cultural significance.

247. With regard to the setting of intertidal heritage assets (section 17.5.3.2), as the distance from shore means that there will be no intervisibility between these assets and the wind turbines, there is no pathway for impact.

248. The potential change to the setting of onshore heritage assets is discussed in **Chapter 22 Onshore Archaeology and Cultural Heritage**.

17.6.3 Potential Effects During Decommissioning

17.6.3.1 Impact 1 Direct (Physical) Impact to Known Heritage Assets

249. As all known heritage assets will be avoided through the retention of AEZs throughout the lifetime of DBS East and DBS West, there is no pathway for impact during decommissioning activities.

17.6.3.2 Impact 2 Direct (Physical) Impact to Potential Heritage Assets

17.6.3.2.1 Magnitude of Impact – DBS East or DBS West in Isolation

250. Direct impacts to potential heritage assets are unlikely to occur as a result of decommissioning as any impacts would already have occurred during installation of the wind farm infrastructure during the construction phase and would already have been subject to appropriate and proportionate additional mitigation measures, as and where necessary.

251. There is, however, potential for impacts to occur if archaeological material is present within the footprint of jack-ups or vessel anchors deployed during decommissioning activities, if these are located in areas which were not previously subject to disturbance. In practice, the nature and extent of individual impacts cannot be fully understood until after the impact has occurred. Therefore, as for construction activities, and as a worst case, there is potential for direct impacts of high adverse magnitude upon potential in situ heritage assets and low adverse magnitude upon potential isolated finds.

17.6.3.2.2 Magnitude of Impact – DBS East and DBS West Together

252. As above, as the magnitude of the impact will not be fully understood until after the potential heritage asset has been encountered and the impact has occurred there is no difference between the potential magnitude of impact for DBS East and DBS West, compared with DBS East or DBS West in isolation. Therefore, without mitigation, and as a precautionary approach, there is potential for direct impacts of high adverse magnitude upon potential in situ heritage assets and low adverse magnitude upon potential isolated finds.

17.6.3.2.3 Sensitivity of Receptor

253. The heritage importance (sensitivity) of potential heritage assets is set out in sections 17.5.1.3, 17.5.2.3 and 17.5.3.3.

254. As a precautionary measure all potential in situ sites are assessed as being of high importance whilst all isolated finds are of medium importance and isolated examples of palaeoenvironmental material of low importance.

17.6.3.2.4 Significance of Effect – DBS East or DBS West in Isolation

255. In accordance with the significance of effect matrix (**Chapter 6 EIA Methodology, Table 6-6**) without mitigation, should impacts occur to in situ sites within either DBS East or DBS West in isolation, these have the potential to be of major adverse significance.

256. Should isolated / derived finds in secondary contexts, or isolated examples of palaeoenvironmental material, be encountered during construction activities, impacts will be of potential minor adverse significance.

17.6.3.2.5 Significance of Effect – DBS East and DBS West Together

257. The potential impact significance for direct (physical) impacts to potential heritage assets, without mitigation, is the same for DBS East and DBS West together as for DBS East and DBS West in isolation (i.e. any direct impacts upon in situ heritage assets have the potential to be of major adverse significance while direct impacts upon isolated finds will be of potential minor adverse significance).

17.6.3.2.6 Mitigation and Residual Significance of Effect – DBS East or DBS West in Isolation

258. The archaeological assessment of any further geophysical data will further reduce, as far as possible, the potential for unintended impacts during decommissioning. If further features of archaeological interest are identified these will be subject to the same mitigation as described for known heritage assets described in section 17.6.1.1.6 with the primary approach being avoidance.

259. In the event of an unexpected discovery, the implementation of a formal protocol for archaeological discoveries, during decommissioning, will allow for such discoveries to be efficiently reported, for advice to be provided and for any further mitigation to be considered on a case by case basis, proportionate to the significance of the discovery.

260. The approach to the implementation of these mitigation measures will be set out the Outline WSI.

261. Although the precise nature of the impact, and the heritage significance of any material impacted, cannot be fully understood until the impact has occurred, it is anticipated that with mitigation the residual magnitude and significance can be reduced or offset so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a minor adverse significance).

17.6.3.2.7 Mitigation and Residual Significance of Effect – DBS East and DBS West Together

262. The combined footprint of potential jack-up and anchor locations during decommissioning for both Projects represents a greater potential for direct impacts than if, for example, only DBS East or DBS West was to be built in isolation. However, the application of a formal protocol for archaeological discoveries to ensure that prompt advice is received in the event of an unexpected discovery, will be the same for the construction of both DBS East and DBS West, as for either Project being built in isolation. Therefore, with the application of mitigation it is anticipated that the residual magnitude and significance can be reduced or offset so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a minor adverse significance).

17.6.3.3 Impact 3 Indirect Impact to Heritage Assets from Changes to Physical Processes

263. Potential indirect impact to heritage assets from changes to physical processes is assessed with reference to section 8.9.5 (Potential Impact during Decommissioning) of **Chapter 8 Marine Physical Environment**.

264. During the decommissioning phase, there is potential for wind turbine foundation and cable removal activities to cause changes in suspended sediment concentrations and/or seabed or shoreline levels because of sediment disturbance effects. The types of effect will be comparable to those identified for the construction phase and there will be no impact to heritage assets.

17.6.3.4 Impact 4 Changes to the Setting of Heritage Assets

265. Decommissioning may result in a further change to the setting of heritage assets with the removal of the wind turbines and associated infrastructure. The presence of vessels, personnel and infrastructure associated with decommissioning activities will also temporarily affect the setting. However, as for construction these impacts are temporary and reversible and the significance of this effect would, therefore, be negligible adverse as the setting will change in a way which does not materially affect its cultural significance.

17.7 Potential Monitoring Requirements

266. Monitoring requirements will be described in the In-Principle Monitoring Plan (IPMP) submitted alongside the DCO application and further developed and agreed with stakeholders prior to construction based on the IPMP and taking account of the final detailed design of the Projects.

267. Anticipated monitoring requirements for Offshore Archaeology and Cultural Heritage will also be described in the Outline WSI (Offshore) which will be submitted alongside the ES and DCO application. It is anticipated that monitoring requirements will consist of archaeological analysis of any pre- and post-construction geophysical and geotechnical survey data to identify known and potentially unknown heritage assets, seabed / palaeolandscape features and to monitor construction and post-construction effects. These will be further developed and agreed with stakeholders prior to construction, taking account of the final detailed design of DBS East and DBS West.

268. It is recognised that monitoring will form an important element in the management and verification of the impacts of DBS East and DBS West. In particular, AEZs will be retained throughout the Project lifetimes and monitoring of AEZs may be required by the regulator to ensure adherence both during construction and in the future operation of DBS East and DBS West (as relevant to Impact 1).

269. Post-construction monitoring may also be required to assess any changes to sediment cover across the Study Area which may result in the exposure or burial of heritage assets, which may affect their long term preservation (see Impact 3). This requirement may be triggered should monitoring during the Projects lifetime show greater than anticipated changes in marine physical processes.

17.8 Preliminary Assessment of Cumulative Effects

270. As detailed in section 17.4.5, this section presents a preliminary assessment of cumulative effects in relation to Offshore Archaeology and Cultural Heritage. The final CEA will be undertaken within the ES chapter.

17.8.1 Initial Screening for Cumulative Effects

271. **Table 17-18** below details the potential cumulative effects that may occur between the Projects and other plans, projects and activities. Only potential impacts assessed in section 17.6 where the potential for cumulative effects has been identified (minor, moderate or major) will be taken forward to the full CEA (i.e. those assessed as 'no impact' are not taken forward as there is no potential for them to contribute to a cumulative impact).

Table 17-18 Potential Cumulative Effects

Impact	Potential for Cumulative Effects	Data Confidence	Rationale
Construction			
Impact 1 Direct (physical) impact to known heritage assets	No	High	Direct cumulative impacts to known heritage assets are unlikely to occur due to the application of AEZs identified through EIA for constructed and planned projects as part of the consenting process.
Impact 2 Direct impact to potential heritage assets	Yes	High	Although the effect of unavoidable impacts will be mitigated by agreed measures as part of the consenting process for each of the constructed and planned projects, the impacts will still have occurred and permanent damage or destruction will have taken place. The assessment of cumulative impacts, therefore, needs to consider the effect of multiple unavoidable impacts from multiple projects upon the archaeological resource.
Impact 3 Indirect impact to heritage assets from changes to physical processes	Yes	High	As set out in **Chapter 8 Marine Physical Environment**, depending on the construction timetable for other offshore wind farms, there is potential for temporal overlap in construction periods which could have a cumulative effect in relation to changes in seabed level due to deposition of suspended sediment plumes.
Impact 4 Changes to the setting of heritage assets	No	High	Impacts to the setting of individual assets are not anticipated to give rise to material harm.
Operation & Maintenance			

Impact	Potential for Cumulative Effects	Data Confidence	Rationale
Impact 1 Direct (physical) impact to known heritage assets	No	High	Direct cumulative impacts to known heritage assets are unlikely to occur due to the continued avoidance and retention of AEZs throughout the life of constructed and planned projects.
Impact 2 Direct impact to potential heritage assets	Yes	High	There is potential for multiple unavoidable impacts associated with operations and maintenance activities (e.g. cable repairs and vessel anchors/jack up legs) during the operation phases of multiple projects
Impact 3 Indirect impact to heritage assets from changes to physical processes	Yes	High	As set out in **Chapter 8 Marine Physical Environment**, cumulative effects could occur due to the presence of the Project alongside other offshore wind farms.
Impact 4 Changes to the setting of heritage assets	No	High	Impacts to the setting of individual assets are not anticipated to give rise to material harm.
Decommissioning			
Impact 1 Direct (physical) impact to known heritage assets	No	High	Direct cumulative impacts to known heritage assets are unlikely to occur due to the continued avoidance and retention of AEZs throughout the life of constructed and planned projects.
Impact 2 Direct impact to potential heritage assets	Yes	High	There is potential for multiple unavoidable impacts associated with decommissioning considered cumulatively with activities associated with other projects.

Impact	Potential for Cumulative Effects	Data Confidence	Rationale
Impact 3 Indirect impact to heritage assets from changes to physical processes	No	High	As no cumulative impacts are anticipated during the decommissioning phase (see Chapter 8 Marine Physical Environment), there is no pathway for cumulative impacts to heritage assets.
Impact 4 Changes to the setting of heritage assets	No	High	Impacts to the setting of individual assets are not anticipated to give rise to material harm.

17.8.2 Plans/Projects Considered for Cumulative Impacts

272. A high-level list of plans/projects that may result in cumulative effects with the Projects is detailed in **Table 17-19**.

273. Plans / projects have been assigned a tier level between 1 and 7, based on the most recent guidance (see **Chapter 6 EIA Methodology**). For the full CEA at ES, this high-level list will be reviewed and screened to ensure all relevant plans / projects are considered in the final assessment. All listed plans / projects will be re-examined at ES to ensure each assigned tier remains accurate at the time of writing.

Table 17-19 High-Level List of Plans/Projects Screened for Further Assessment in the Full CEA

Tier	Plan / Project	Distance to Offshore Development Area (km)
Strategic Plans		
7	East Inshore, North East Inshore, East Offshore and North East Offshore Marine Plans	Within offshore development area
Offshore Wind Farms		
2	Dogger Bank A	7
2	Dogger Bank B	17
3	Dogger Bank C	56

Tier	Plan / Project	Distance to Offshore Development Area (km)
6	Dogger Bank D	68 (estimated))
2	Sofia	34
4	Hornsea Project Four	20
Carbon Capture and Storage		
3	Northern Endurance CCS	2
7	CCS North Sea Leasing Round – SNS Areas 1 & 3	Within array areas
Subsea Cables		
2	Viking Link Interconnector	29
6	Eastern Link 2 (SEGL2)	2
7	Third Eastern Link HVDC cable (TGDC)*	Crosses offshore export cable corridor
7	Fourth Eastern Link HVDC cable (E4L5)*	Crosses offshore export cable corridor
7	National Grid HND Bootstrap*	Potentially within the array areas

**Cable route not yet finalised*

17.9 Transboundary Effects

274. Transboundary impacts to individual heritage assets will not occur due to the localised nature of disturbance which do not cross territorial borders.

275. However, although DBS East and DBS West are within the UK's EEZ, any data acquired and archaeologically assessed as part of the Projects also has the potential to feed into wider research objectives initiated by neighbouring EEZs in the North Sea. In terms of palaeolandscapes, Doggerland was a landscape of central importance in northern Europe, larger than many current European countries, and boasting a wealth of unexplored archaeology and environmental data vital to our understanding of how past populations met challenges of climate change and sea-level rise. With regard to maritime and aviation archaeology, the North Sea has played host to numerous conflicts, migration and trade routes and wrecks and aircraft from multiple nations are known to be present on the seafloor. Therefore, impacts discussed above, are not restricted to the UK's EEZ and transboundary effects should also be considered.

276. The nature of these transboundary effects are also connected to cumulative effects and the potential for integrated research and management to represent a positive cumulative, transboundary impact of development-led initiatives across all sectors of the North Sea. Alongside data produced through UK offshore wind farm development, and that of other European nations bordering the North Sea, data sharing across national boundaries has the potential to result in a significant beneficial impact. However, as described in section 17.4.5, at PEIR stage a CEA has not been provided as the relevant other plans, projects and activities are likely to change prior to the submission of the DCO application. Full consideration to these potential transboundary effects will be provided alongside the CEA at ES stage.

17.10 Interactions

277. The effects identified and assessed in this chapter have the potential to interact with each other. The areas of potential interaction between effects are presented in **Table 17-20**. This provides a screening tool for which effects have the potential to interact. **Table 17-21** provides an assessment for each receptor (or receptor group) as related to these impacts.

278. Within **Table 17-21** the effects are assessed relative to each development phase to see if multiple effects could increase the significance of the effect upon a receptor. Following this a lifetime assessment is undertaken which considers the potential for effect to affect receptors across all development phases.

Table 17-20 Interactions Between Impacts - Screening

Potential Interactions between Impacts				
Construction				
	Impact 1: Direct impact to known heritage assets	Impact 2: Direct impact to potential heritage assets	Impact 3: Indirect impact to heritage assets from changes to physical processes	Impact 4: Impacts to the setting of heritage assets and historic seascape character
Impact 1: Direct impact to known heritage assets	-	No	No	No
Impact 2: Direct impact to potential heritage assets	No	-	Yes	Yes
Impact 3: Indirect impact to heritage assets from changes to physical processes	No	Yes	-	Yes
Impact 4: Impacts to the setting of heritage assets and historic seascape character	No	Yes	Yes	-

Potential Interactions between Impacts				
Operation				
	Impact 1: Direct impact to known heritage assets	Impact 2: Direct impact to potential heritage assets	Impact 3: Indirect impact to heritage assets from changes to physical processes	Impact 4: Impacts to the setting of heritage assets and historic seascape character
Impact 1: Direct impact to known heritage assets	-	No	No	No
Impact 2: Direct impact to potential heritage assets	No	-	Yes	Yes
Impact 3: Indirect impact to heritage assets from changes to physical processes	No	Yes	-	Yes
Impact 4: Impacts to the setting of heritage assets and historic seascape character	No	Yes	Yes	-

Potential Interactions between Impacts				
Decommissioning				
	Impact 1: Direct impact to known heritage assets	Impact 2: Direct impact to potential heritage assets	Impact 3: Indirect impact to heritage assets from changes to physical processes	Impact 4: Impacts to the setting of heritage assets and historic seascape character
Impact 1: Direct impact to known heritage assets	-	No	No	No
Impact 2: Direct impact to potential heritage assets	No	-	Yes	Yes
Impact 3: Indirect impact to heritage assets from changes to physical processes	No	Yes	-	Yes
Impact 4: Impacts to the setting of heritage assets and historic seascape character	No	Yes	Yes	-

Table 17-21 Interaction Between Impacts - Phase and Lifetime Assessment

Receptor	Highest Significance Level				
	Construction	**Operation**	**Decommissioning**	**Phase Assessment**	**Lifetime Assessment**
Potential heritage assets	Minor adverse	Minor adverse	Minor adverse	No greater than individually assessed impact. While impacts to known heritage assets can be avoided, potential heritage assets may be subject to direct physical impact, indirect impacts from changes to physical processes and from changes to their setting (i.e. an artefact removed from the seabed). Once an impact has occurred (i.e. a new heritage asset has been discovered / encountered) the application of additional mitigation (such as additional recording, AEZs, micro-siting or relocation) means that the magnitude of each, spatially discrete impact (should an impact occur), will be no greater across all phases than each phase in isolation.	No greater than individually assessed impact As for the phase assessment, once a new heritage asset is discovered or encountered, the application of additional mitigation means that that the magnitude of each, spatially discrete impact (should an impact occur), will be no greater across the Projects' lifetime.

17.11 Inter-relationships

279. For Offshore Archaeology and Cultural Heritage potential inter-relationships between other topics assessed within this PEIR including Marine Physical Processes and Onshore Archaeology and Cultural Heritage. A summary of the potential inter-relationships is provided in **Table 17-22**.

Table 17-22 Offshore Archaeology and Cultural Heritage Inter-Relationships

Topic and Description	Related Chapter	Where Addressed in this Chapter	Rationale
Construction			
Indirect impact to heritage assets from changes to physical processes	**Chapter 8 Marine Physical Environment**	Section 17.6.1.3	Significant changes to physical processes may impact the preservation / survival of buried / exposed heritage assets.
Changes to the setting of heritage assets	**Chapter 22 Onshore Archaeology and Cultural Heritage**	Addressed in **Chapter 22 Onshore Archaeology and Cultural Heritage**	Impacts to the setting of heritage assets onshore may occur due to activities associated with the installation of offshore infrastructure.
Operation			
Indirect impact to heritage assets from changes to physical processes	**Chapter 8 Marine Physical Environment**	Section 17.6.2.3	Significant changes to physical processes may impact the preservation / survival of buried / exposed heritage assets.
Changes to the setting of heritage assets	**Chapter 22 Onshore Archaeology and Cultural Heritage**	Addressed in **Chapter 22 Onshore Archaeology and Cultural Heritage**	Impacts to the setting of heritage assets onshore may occur due to activities associated with the installation of offshore infrastructure.

Topic and Description	Related Chapter	Where Addressed in this Chapter	Rationale
Decommissioning			
Indirect impact to heritage assets from changes to physical processes	**Chapter 8 Marine Physical Environment**	Section 17.6.3.3	Significant changes to physical processes may impact the preservation / survival of buried / exposed heritage assets.
Changes to the setting of heritage assets	**Chapter 22 Onshore Archaeology and Cultural Heritage**	Addressed in **Chapter 22 Onshore Archaeology and Cultural Heritage**	Impacts to the setting of heritage assets onshore may occur due to activities associated with the installation of offshore infrastructure.

17.12 Summary

280. This chapter has provided a characterisation of the existing environment for Offshore Archaeology and Cultural Heritage based on existing data which has established that with mitigation all potential impacts will be avoided or of minor adverse significance.

281. There are no known in situ prehistory sites within the Study Area. However, considering the location of DBS at the western margin edge of the Dogger Bank which is known to preserve palaeolandscape features and deposits of archaeological interest, and the recovery of organic and palaeoenvironmental material in a borehole located in DBS, there is high potential for submerged prehistoric landscape features and deposits to be present. This potential will be assessed using project-specific geophysical and geotechnical data and incorporated into the ES.

282. With regard to maritime and aviation archaeology, site specific geophysical data has been acquired and is currently being assessed by Wessex Archaeology. The assessment results will inform the ES. A desk-based review of existing records of wrecks and seabed features demonstrates the presence of 14 wrecks and two records of debris which are considered likely to be of archaeological interest. In addition there are seven records relating to recent losses of vessels, a pipeline and the recent loss of a cargo of wrought iron bars which are not of archaeological interest. A further 55 records correspond to natural features or to locations where the presence or absence of anthropogenic material is less certain. A number of reported losses of historic vessels, primarily 19th century fishing and cargo vessels of local vernacular types, are also reported within 5km of the Study Area, including three records corresponding to WWII military aircraft losses. The potential for further maritime and aviation archaeological material will be further clarified following the assessment of marine geophysical data by Wessex Archaeology with the results included in the ES.

283. Within the intertidal zone, there is high potential for the discovery of isolated finds, and potentially *in situ* features in the cliff face which may include palaeoenvironmental evidence, as indicated by the organic deposit in the Ulrome Cliffs (Humber HER 18037) observed during the heritage walkover (Appendix 22-3). Due to the high levels of erosion of the cliffs, archaeological material is eroding from both the cliff top, and buried within the cliffs themselves, and the fragmented remains of former WWII coastal defences were also observed during the heritage walkover.

284. The historic seascape character of the Study Area is primarily associated with commercial fishing activities with documentary evidence for fishing on the Dogger Bank from at least the 14th century. The presence of the wind farm infrastructure is not anticipated to fundamentally alter perceptions of the historic fishing industry. Whilst fishing activities are temporarily displaced as a result of construction works, fishing activities will still be permitted in areas of the offshore development not undergoing construction activities. Also, the distance of the DBS East and DBS West wind farm sites from the coast, and the minimal above ground infrastructure at the coast, means that the Projects will be largely undetectable by the public and historic perceptions of the traditional fishing industry, which the HSC described as having taken on a 'quaint' character, a memory of better days, will remain largely unchanged.

285. A further dominant character type mapped within the Study Area is hydrocarbon industry. The most significant change since compilation of the HSC dataset is the introduction of new offshore wind farms to the north and south of DBS. Overall, perceptions of the North Sea energy industry place greater emphasis upon nuclear power and renewable energy and changing perceptions associated with the construction of DBS are therefore likely to be seen as part of this natural progression for energy generation and as a positive change from fossil fuels to renewable energy.

286. Until the final design and layouts are confirmed, there will remain uncertainty in the precise nature and extent of any direct impacts, however, it is anticipated that, within the intertidal zone, the use of trenchless techniques, with entry on the landward side of the cliffs, and exit below MLWS in the subtidal, will mean that impacts to potential intertidal archaeological material will be avoided. The depth of sedimentary sequences of archaeological interest at the landfall will be further clarified through the geoarchaeological assessment of geotechnical data, and will inform the trenchless cable installation design so that it will pass beneath deposits of potential archaeological interest. However, should an exit in the intertidal zone be selected there would be potential for direct impact to archaeological material that may be buried within beach deposits.

287. With the application of mitigation, it is anticipated that all direct impacts to known heritage assets as a result of DBS East and DBS West will be avoided. For the purposes of this PEIR, AEZs (comprising 100m buffers around the recorded point locations) are recommended for the 14 wrecks and two recorded items of debris at which the presence of archaeological material is considered likely. The nature and extent of these AEZs (including any recommendations for further AEZs around newly identified features of archaeological interest) will be refined following completion of the archaeological assessment of marine geophysical data.

288. Similarly, the distribution of features of possible archaeological interest, as seen in the geophysical data, will also be identified in the ES. Where possible, these features of possible interest will be avoided through micro-siting of the design. If features cannot be avoided, then additional work may be required (to be undertaken post-consent) to establish the archaeological interest of the feature (e.g. investigation of individual anomalies (ground truthing) through ROV and / or diver survey). Once the character, nature and extent of selected features are more fully understood, appropriate mitigation measures (proportionate to the significance of the asset) to reduce or off-set impacts can be determined on a case by case basis.

289. In order to further minimise potential impacts, the archaeological assessment of high-resolution geophysical data and geoarchaeological assessment of geotechnical data will be undertaken post-application / post-consent in order to reduce, as far as possible, the potential for unintended impacts during construction. In the event of an unexpected discovery, this will be reported using a formal protocol for archaeological discoveries which will establish whether the recovered objects are of archaeological interest and recommend appropriate mitigation measures where necessary. Through the protocol, any possible in situ heritage assets encountered on the seabed will be immediately provided with a temporary exclusion zone to prevent further impacts from taking place until advice had been received. Following confirmation of the presence of archaeological material, additional mitigation measures to record or conserve the site will be agreed in consultation with Historic England.

290. With the application of mitigation it is anticipated that the residual magnitude and significance can be reduced or offset so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a minor adverse significance)

291. The approach to the implementation of these mitigation measures will be set out in an Outline WSI (Offshore) which will be submitted alongside the ES and DCO application.

Table 17-23 Summary of Potential Likely Significant Effects on Offshore Archaeology and Cultural Heritage

Potential Impact	Receptor	Importance (Sensitivity)	Magnitude of Impact	Pre-mitigation Effect	Mitigation Measures Proposed	Residual Effect	Residual Cumulative Effect
Construction							
Impact 1 Direct impact to known heritage assets	Known wrecks and debris of archaeological interest	High	High	Major adverse	AEZs	No change	
Impact 2 Direct impact to potential heritage assets	In situ prehistoric, maritime or aviation sites	High	High	Major adverse	Further assessment and investigation and additional mitigation to avoid, reduce or offset impacts.	Minor adverse	
	Isolated finds	Medium	Low	Minor adverse	Protocol for archaeological discoveries	Minor adverse	

Potential Impact	Receptor	Importance (Sensitivity)	Magnitude of Impact	Pre-mitigation Effect	Mitigation Measures Proposed	Residual Effect	Residual Cumulative Effect
Impact 3 Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Medium to high	No impact	No change	N/A	No change	
Impact 4 Impacts to the setting of heritage assets	Known and potential heritage assets	Medium to high	No impact	No change	N/A	No change	
Operation							
Impact 1 Direct impact to known heritage assets	Known heritage assets	Medium to high	High	Major adverse	AEZs	No impact	

Potential Impact	Receptor	Importance (Sensitivity)	Magnitude of Impact	Pre-mitigation Effect	Mitigation Measures Proposed	Residual Effect	Residual Cumulative Effect
Impact 2 Direct impact to potential heritage assets	In situ prehistoric, maritime or aviation sites	High	High	Major adverse	Further assessment of geophysical and geotechnical data.	Minor adverse	
	Isolated finds	Medium	Low	Minor adverse	Protocol for archaeological discoveries.	Minor adverse	
Impact 3 Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Medium to high	No impact	No change	N/A	No change	
Impact 4 Impacts to the setting of heritage assets	Known and potential heritage assets	Medium to high	No impact	No change	N/A	No change	

Potential Impact	Receptor	Importance (Sensitivity)	Magnitude of Impact	Pre-mitigation Effect	Mitigation Measures Proposed	Residual Effect	Residual Cumulative Effect
Decommissioning							
Impact 1 Direct impact to known heritage assets	Known wrecks and debris of archaeological interest	High	High	Major adverse	AEZs	No impact	
Impact 2 Direct impact to potential heritage assets	In situ prehistoric, maritime or aviation sites	High	High	Major adverse	Further assessment and investigation and additional mitigation to avoid, reduce or offset impacts.	Minor adverse	
	Isolated finds	Medium	Low	Minor adverse	Protocol for archaeological discoveries	Minor adverse	

Potential Impact	Receptor	Importance (Sensitivity)	Magnitude of Impact	Pre-mitigation Effect	Mitigation Measures Proposed	Residual Effect	Residual Cumulative Effect
Impact 3 Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Medium to high	No impact	No change	N/A	No change	
Impact 4 Impacts to the setting of heritage assets	Known and potential heritage assets	Medium to high	No impact	No change	N/A	No change	

References

Allen, M.J., Bronk Ramsey, C., McNeill, E., Meadows, J., van der Plicht, J. and Selby, I. (2008) 'Radiocarbon dating of a mammoth tusk from the Southern North Sea reported upon through the English Heritage / BMAPA awareness programme', Quaternary Newsletter 116: 7.

Bicket A and Tizzard L (2015) A review of the submerged prehistory and palaeolandscapes of the British Isles Proc Geol Assoc 126, 6 643-663

CIfA (2020) Standard and Guidance for Historic Environment Desk-Based Assessment. Available at: https://www.archaeologists.net/sites/default/files/CIfAS%26GDBA_4.pdf. Accessed: 01/12/2022.

CIfA (2022) Code of Conduct: Professional Ethics in Archaeology. Available at: https://www.archaeologists.net/sites/default/files/Code%20of%20conduct%20revOct2022.pdf. Assessed: 01/12/2022.

Coles, B. (1998). Doggerland: A Speculative Survey. Proceedings of the Prehistoric Society,64, 45-81.

DEFRA (2011) Marine Policy Statement. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf . Accessed: 01/12/2022.

DEFRA (2014) East Inshore and East Offshore Marine Plans. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/312496/east-plan.pdf. Accessed: 01/12/2022.

Department for Business, Energy & Industrial Strategy (2021a) Draft Overarching National Policy Statement for Energy (EN-1). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015233/en-1-draft-for-consultation.pdf. Accessed 28/11/22.

Department for Business, Energy & Industrial Strategy (2021b) Draft National Policy Statement for Renewable Energy Infrastructure (EN 3). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015236/en-3-draft-for-consultation.pdf. Accessed 28/11/22.

Department for Business, Energy & Industrial Strategy (2021c) Draft National Policy Statement for Electricity Networks Infrastructure (EN-5). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015238/en-5-draft-for-consultation.pdf. Accessed 28/11/22.

Department of Energy and Climate Change (2011a) Overarching National Policy Statement for Energy (EN-1). Presented to Parliament pursuant to Section 5(9) of the Planning Act 2008. The Stationary Office, London.

Department of Energy and Climate Change (2011b) National Policy Statement for Renewable Energy Infrastructure (EN-3). Presented to Parliament pursuant to Section 5(9) of the Planning Act 2008. The Stationary Office, London.

Department of Energy and Climate Change (2011c) National Policy Statement for Electricity Networks Infrastructure (EN-5). Presented to Parliament pursuant to Section 5(9) of the Planning Act 2008. The Stationary Office, London.

Gribble, J. and Leather, S. (2011) Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector. Guidance prepared by Emu and issued by COWRIE. Available at: https://www.historicenvironment.scot/media/2376/2011-01-offshore-geotechnical-investigations-and-historic-environment-analysis-guidance-for-the-renewable-energy-sector.pdf. Accessed: 01/12/2022.

Emery, A.R., Hodgson, D.M., Barlow, N.L., Carrivick, J.L., Cotterill, C.J. and Phillips, E. (2019). 'Left high and dry: deglaciation of Dogger Bank, North Sea, recorded in proglacial lake evolution' Frontiers in Earth Science 7, 234.

Evans, D.J.A. and Thomson, S.A. (2010) Glacial sediments and landforms of Holderness, eastern England: A glacial depositional model for the North Sea lobe of the British – Irish Ice Sheet. Earth Science Reviews, v101, n 3-4 (201008), pp147- 189.

Fitch, S., Thomson, K. and Gaffney, V. (2005). Late Pleistocene and Holocene depositional systems and the palaeogeography of the Dogger Bank, North Sea. Quaternary Research, 64(2), pp.185-196.

Gaffney V, Thomson, K and Fitch S (2007) Mapping Doggerland: the Mesolithic landscapes of the southern North Sea. Archaeopress

Historic England (2013) Marine Geophysics Data Acquisition, Processing and Interpretation. Guidance prepared by Plets, R., Dix, J., Bates, R. Available at: https://historicengland.org.uk/images-books/publications/marine-geophysics-data-acquisition-processing-interpretation/mgdapai-guidance-notes/. [Accessed: 01/12/2022.

Historic England (2017) The Setting of Heritage Assets. Historic Environment Good Practice Advice in Planning Note 3 (Second Edition). Available at: https://historicengland.org.uk/images-books/publications/gpa3-setting-of-heritage-assets/heag180-gpa3-setting-heritage-assets/. Accessed: 01/12/2022.

Historic England (2022) Opportunities and Threats to the Maritime Environment. Available at: https://historicengland.org.uk/research/current/threats/martime-marine/. Accessed: 13/12/2022.

IEMA, IHBC and CIfA (2021) Principles of Cultural Heritage Impact Assessment in the UK. Available at: https://www.archaeologists.net/sites/default/files/j30361_iema_principlesofchia_v8.pdf. Accessed: 01/12/2022.

JNAPC (2006) Code for Practice for Seabed Development. Available at: http://www.jnapc.org.uk/jnapc_brochure_may_2006.pdf. Accessed: 01/12/2022.

LUC (2017a) National Historic Seascape Characterisation (NHSC): Technical Advice Document. Available at: http://archaeologydataservice.ac.uk/archiveDS/archiveDownload?t=arch-2958-

1/dissemination/pdf/National_HSC_Database_Technical_Advice_Document.pdf. Accessed: 04/14/2023.

LUC (2017b) National Historic Seascape Characterisation (NHSC): User Guide. Available at: http://archaeologydataservice.ac.uk/archiveDS/archiveDownload?t=arch-2958-1/dissemination/pdf/National_HSC_Database_User_Guide.pdf. Accessed: 04/14/2023.

LUC (2017c) Historic Seascape Characterisation (HSC): Consolidating the National HSC. Available at: http://archaeologydataservice.ac.uk/archiveDS/archiveDownload?t=arch-2958-1/dissemination/pdf/Consolidating_the_National_HSC_Database_Project_Report_-_Final_Report.pdf. Accessed: 04/14/2023.

MHCLG (2021) National Planning Policy Framework. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf . Accessed: 01/12/2022.

Oxford Archaeology (2008) Guidance for the Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy. Guidance prepared by Oxford Archaeology and issued by COWRIE. Available at: http://www.biofund.org.mz/wp-content/uploads/2018/11/F1349.Cowrie-Ciarch-Web.pdf. Accessed: 01/12/2022.

Phillips, E., Cotterill, C., Johnson, K., Crombie, K., James, L., Carr, S. and Ruiter, A. (2018). 'Large-scale glacitectonic deformation in response to active ice sheet retreat across Dogger Bank (southern central North Sea) during the Last Glacial Maximum', Quaternary Science Reviews 179, 24-47.

Reid, C. (913) Submerged Forests, Cambridge Series of Manuals of Literature and Science. Oxford

Russell, J. W. and Stevens, C. J (2014) Palaeoenvironmental assessment of peat samples. The Crown Estate.

The Crown Estate (2014). Protocol for Archaeological Discoveries: Offshore Renewables. Available at: https://www.wessexarch.co.uk/sites/default/files/field_file/2_Protocol%20For%20Archaeological%20Discoveries.pdf. Accessed: 01/12/2022.

The Crown Estate (2021) Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects. Available at: https://www.thecrownestate.co.uk/media/3917/guide-to-archaeological-requirements-for-offshore-wind.pdf. Accessed: 01/12/2022.

Wessex Archaeology (2007) Historic Environment Guidance for the Offshore Renewable Energy Sector. Guidance prepared by Wessex Archaeology and issued by COWRIE. Available at: https://www.wessexarch.co.uk/sites/default/files/field_file/COWRIE_2007_Wessex_%20-%20archaeo_%20guidance_Final_1-2-07.pdf. Accessed: 01/12/2022.

Wessex Archaeology (2013a) Dogger Bank Tranche A (Creyke Beck) Environmental Impact Assessment Archaeology and Cultural History Technical Report, Salisbury unpublished report 78040.05

Wessex Archaeology (2013b) Dogger Bank Teesside A & B Marine and Coastal Archaeology Environmental Impact Assessment Technical Report – Appendix 2 Geophysical Assessment Tranche B, Salisbury, unpublished rep 78041.04

Wessex Archaeology (2014) Offshore Renewables Protocol for Archaeological Discoveries ORPAD Palaeoenvironmental Assessment of Peat Samples. Salisbury, unpublished report 86900.02.

Wessex Archaeology (2020a) Dogger Bank Creyke Beck Archaeological Assessment of Marine Geophysical Data. Salisbury, unpublished report 201322.01

Wessex Archaeology (2020b) Creyke Beck Offshore Wind Farms Export Cable Corridor Stage 1 and Stage 2 Geoarchaeological Assessment of Vibrocores. Salisbury, unpublished report 201321.01.

Wessex Archaeology (2022) Dogger Bank A, B & C Offshore Wind Farm Stage 1 & Stage 2 Geoarchaeological Assessment of Geotechnical Data (2020 & 2021). Salisbury, unpublished report 201324.01

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